BULLETIN

OF THE

Society for the Promotion of Engineering Education

Vol. IV LANCASTER, PA., FEBRUARY, 1914 No. 6

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EDITORIALS.

The Princeton Meeting. In preparation for the coming meeting the BULLETIN will print a series of sketches of characteristic phases of Princeton life. The first of these is a digest of Dean West's essay on the graduate college. This essay reflects the spirit of the institution and is a fine piece of literature. We can only present the substance and, we hope, the spirit, without the literary form which characterizes the original.

The program of the meeting is well in hand. Experience with recent meetings has been utilized in developing a simple, practical, uncrowded, stimulating program with ample opportunity for "mixing." In addition to the committee reports, which make up the major portion of the program, there are not more than six papers which are being written on the basis of tangible data. There will be no trite generalizations. The presence of the official delegates from our large and growing institutional membership will insure definiteness of procedure.

The Committee on Secondary Schools. In commenting on needed revision of the curriculum of the technical school recently, Dr. C. P. Steinmetz expressed the opinion that we are largely restricted by the methods of the secondary and the primary schools. The secondary schools have two distinct functions, namely, to prepare many students for business life and to fit a few for college. Unfortunately at present these two functions impose conflicting requirements. The ideal course of instruction would be that in which a student could drop out anywhere along the line and, having done consistent work, be prepared to profit by the opportunities afforded him in the business world without unnecessary handicap. In other words, it should not be necessary for a high-school student to decide early in his course whether he wants to go to college or not. It is eminently proper that students able and likely to benefit by college training should be encouraged to get it but the larger portion of the student body should not suffer thereby.

While numerically few, the "high brows" are apt to get the lion's share of attention, because they reflect more immediate credit upon their teachers. Just what the high-school curriculum should be in its relation to that of the college must be worked out through intelligent coöperation between the faculties of secondary schools and colleges. This coöperation, although increasing, is still not as great as it should be. All of which is preliminary to the statement that the committee on secondary schools of this society has plenty of work ahead. Some of the chairman's ideals are stated elsewhere in this issue.

THE GRADUATE COLLEGE OF PRINCETON.

The new graduate college was opened on October 22, 1913. On that day the Princeton University Press published a reprint from the *Century Magazine* of an essay by Dean Andrew F. West entitled "The Graduate College of Princeton with some Reflections on the Humanizing of Learning." The essay was amplified and revised by Dean West prior to reprinting. The article is illustrated with pen drawings by John P. Cuyler.

This essay contains a summary of the principles underlying the new college and conveys the spirit which it is designed to inspire. Deploring the tendency of the industrial activity of this country to depreciate the value of scholarship the author shows how the new college will tend to promote it. "Like civil liberty, the higher knowledge is always in peril and always worth fighting for. Just now it is facing the perils of deterioration and dismemberment. Among the forces that threaten it the commercial spirit is probably the strongest. It means the pursuit of only such knowledge as 'pays,' the absorption in materials ends, the rating of a living as higher than a life. This spirit, not satisfied with engrossing the business life of the country and at times menacing its political integrity, seeks to affect every part of our education."

According to Dean West "another threatening force is unenlightened specialization. It breaks the structure of higher

(Courtesy Princeton Press.)

CLEVELAND TOWER AND ENTRANCE GATE FROM NORTHWEST.

GRADUATE COLLEGE OF PRINCETON FROM EAST. *(Courtesy Princeton Press.)*

knowledge into fragments. That the scholar should be in some important sense a specialist is true. That he should be only a specialist is a calamity to himself and to others. True specialization has its indispensable value in the exact determination of particulars and in accurately relating particulars to the general. But the man who is only a specialist is an intellectul fraction. He is no longer whole-minded, and whole-minded men are what our scholarship most needs."

Dean West then points out the fundamentals of true education and especially the relation of the student to the success of the educational process both in undergraduate and graduate study. He feels that not enough attention has been given to the whole life of the graduate student and to the selection of the proper type of student. "All those and only those who show capacity and desire for high intellectual effort should be encouraged to enter. The graduate student body is no place for either shallow dabbling, narrow intensity, dull mediocrity or unsocial isolation. Young men, young in spirit, rich in intellectual and moral worth, responsive to scholarly impulses, eager to seek and find, able to perceive, take and use the more valuable as distinguished from the less valuable material of knowledge, willing to do all and dare all to make themselves master-students, open-eyed to ideas in their relevancy, worth and beauty, pulsing with energy, inventiveness and fantasy, men companionable, magnanimous and unselfish, such are the students to be longed for and prized supremely. These are the sons of knowledge who are best fitted to live not for themselves alone or by themselves alone, but first in the household of knowledge and then in the larger society of the world. On the basis of such convictions the graduate college of Princeton was planned."

"Three elements compose the graduate college. First and foremost is a body of thoroughly first-rate professors, to be added to others now in the faculty—interesting men, scholars of high power, eminent in their subjects and able to waken young men. . . . The second element is a company of students

of high ability—not a big crowd, but a moderate number—living in a community in the buildings of the graduate college. The number may be a hundred or so, perhaps more—but I hope not a great many more. Quality first, quantity afterwards. The important thing is that they shall make a student community of high type, sufficient in number to develop a society where every man may know his fellows, find the variety he needs, and not be lost in a crowd. The sole test of admission is mental and moral worth. . . . The third element is the buildings, the material home wherein this community shall find the realization of its desires. The conditions of student life in Princeton are distinctive. They are not urban or suburban or rustic, but rural. Here is the only large old college in a very small town. Its dominant tradition is well-rooted and comparatively pure. The graduate college is the flowering of this root. Whatever may be true of other subjects, liberal studies at least take on new charms amid old associations, and find a natural home in the peace and sylvan beauty of rural life. In order to make the buildings attractive and beautiful the so-called college Gothic was chosen—not "modified" Gothic, nor hotel Gothic, but the exquisite perpendicular type, so lovely in the few remaining examples in English colleges. Why do students naturally love such buildings? I think it is because, with the scenic setting, they look inviting, domestic, poetic, and seem in some way ancestral to universities. Quadrangles shadowing sunny lawns, towers and gateways opening quiet retreats, ivy-grown walls looking on sheltered gardens, vistas through avenues of arching elms, walks that wind among the groves of Academe—these are the places where the affections linger and where memories cling like the ivies themselves, and these are the answer in architecture to the immemorial longings of academic generations back to the time when universities first began to build their homes."

It is in these surroundings and in this spirit that the graduate college of Princeton hopes to maintain a center of learning where the purpose will not be the pursuit of a degree but

where men shall strive to learn to serve their fellows. A place where a mind and a heart of broad scholarship shall be found and where good fellowship in the best sense shall counteract the dangers of excessive specialization.

PRESIDENT MACLAURIN'S ANNUAL REPORT.

The report of the president of the Massachusetts Institute of Technology is especially interesting this year. For many years the institute has been hampered by lack of space and lack of funds. Both of these restrictions are in process of removal although, as President Maclaurin points out, most of the liberal gifts recently received have "strings to them" and do not provide for ordinary but necessary expenses such as lighting and heating. Nevertheless the institute is highly fortunate in having in immediate prospect the beautiful group of buildings illustrated and described in the last issue of the *Technology Quarterly*. The design of these is in the hands of Wm. W. Bosworth as chief architect and Professor Jas. K. Taylor, as consulting architect. The construction engineers are the Stone & Webster Engineering Corporation. All of the names mentioned are those of loyal Technology alumni.

Among the many significant statements in President Maclaurin's report an important one refers to the research work recently organized in the electrical engineering department. This is due largely to coöperation between the institute and the American Telegraph & Telephone Company, the president of which, Mr. Theodore N. Vail, has recently become a member of the corporation. A properly-staffed laboratory has also been added to the department. Instruction in aerodynamics has also been added to the curriculum, Mr. J. C. Hunsaker, of the government corps of naval constructors, having been detailed for service at the institute for this purpose. A third educational departure is the addition of a course in industrial

physics. Consideration is also being given to the demand for instruction in business administration.

COÖPERATION BETWEEN HARVARD AND MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

All friends of technical education will welcome the announcement that these two great institutions have buried their differences and are to combine for the promotion of technical instruction. An agreement has been reached under which members of the engineering faculty of each become members of the corresponding faculty of the other.

The coöperation is definitely limited to the great fields of engineering—mechanical, electrical, civil, sanitary, and mining, all of which involve great expense in the maintenance of extensive and costly laboratories. In the interests of efficiency and convenience, for the concentration of effort and the elimination of waste and lost motion, it is agreed that all the work of education and research in these important branches of applied science shall be carried on within the buildings of the institute to be erected on its new site in Cambridge, bordering on Massachusetts Avenue and the Charles River Embankment. These buildings are being erected, arranged and equipped.

For the maintenance and equipment of these laboratories and the payment of salaries, the university agrees to set aside practically all the money that it would otherwise be free to devote to education of this type. The institute, on its part, agrees to devote to the same general purpose all the funds or the income of funds that it now holds for carrying on work in the departments of engineering that have been named, and both institutions agree that their respective measures of support may be increased from time to time if disposable funds are available.

From the point of view of Harvard University, its president, A. Lawrence Lowell, makes the following statement, which shows the broadness of spirit with which his institution enters into the agreement.

Friends of Harvard University and the Massachusetts Institute of Technology—and they have many friends in common—have long deplored the rivalry of two schools of engineering competing on opposite sides of a river. The disadvantages have been made even more evident by the decision of the institute to cross the Charles; but the difficulty of making an arrangement satisfactory to both parties has hitherto been very great, and, in fact, the obstacles to a combination between rival institutions supported by and serving the same community have been one of the grave defects of higher education in America. This difficulty seems at last to have been overcome here by a plan for coöperation in the conduct of one school of engineering and mining. The plan is favorable to both institutions. Both gain thereby. Which gains the more can probably not be determined, and certainly has not been computed; for the leading motive with the authors of the agreement has lain in another plane. Both institutions exist for the promotion of instruction and research. Each is a means to an end larger than itself, the welfare of the community as a whole; and that both acting in concert can further this end better than either working alone cannot be doubted. By the combination of resources and momenta a school ought to be maintained unequalled on this continent—and perhaps in the whole world.

WHOSE FAULT IS IT?

One cause of difficulty and incomplete success in technical education results from the teacher's lack of knowledge of what the graduate is "up against." All teachers should read the following communication and editorial reply which appeared in the October Mechanical edition of the *Railway Age Gazette*, one of the most influential engineering papers in the country. They bear on a fundamental topic.

These communications were the cause of an animated discussion which is not over yet. Among others Prof. A. J. Wood took a hand, his letter being printed in the December issue. Reprints of this letter are available. Prof. Wood quotes from Mr. Ivy L. Lee's Minneapolis S. P. E. E. paper and replies to Mr. Lee's criticism of the technical graduate, applying his argument also to the case taken up in the following paragraphs. Before quoting these, attention may well be directed to a paper by Mr. Geo. M. Basford, delivered early in

January before the New England Railroad Club, which sheds much light on the controversy and, perhaps, explains the failure of the railroads to hold college men.

WHY DON'T RAILROADS HOLD THE COLLEGE MAN?

To the Editor, *Railway Age Gazette:*

"About 2 per cent. of the college men we employ stay with us," reports a motive power man on one of the big trunk lines. Scan the records of any road taken at random or any number of roads; note the number and names of the college men entering the service of a road and follow them through—one, two, five years, and in nine cases out of ten it will be found that, at the end of five years, only about 10 per cent. remain. Although they know this condition, few officials have done anything to correct it. Why do the college men leave railroad service, especially in the motive power department? They are better taken care of during slack times than the rank and file in other activities, they are shown every courtesy, and given every opportunity to advance while learning. Yet they leave; some in two or three months, others in two or three years.

The reasons are many, but usually simple, and it is surprising how little is done to hold the college-trained man. Take the man, for instance, who enters the motive power department. He is usually a graduate in mechanical engineering and decides to become a special apprentice. Without casting any reflections on the piece-work system, it is generally a fact that if he enters a piece-work shop he is decidedly unfortunate and his time is practically wasted. This is borne out by unsolicited statements of the men themselves. There is only one way to teach a man to do things—have him do them! A machinist or other skilled laborer in a piece-work shop is busy, far too busy to have time to show some one else how to do the work properly; he not only does not have time, but he can't and won't afford it. Every minute taken from his work means just so much from his pay envelope. Go through a piece-work shop and you can doubtless count on the fingers of one hand the number of apprentices running big machines. In the parlance of the

shop, "they don't get a show." To be sure, they are allowed to stand by and be helpers, hold a brush and help transfer work to and from floor and machine; they can ask all the questions they wish and gain much useful knowledge, but will they be able to handle tools intelligently? Can they tell others how they want a thing done? Hardly. These are conditions as they exist in one of our biggest railroad shops in Pennsylvania, and the apprentices spend four years at it too. Is it any wonder that some of them leave rather than be a "brush holder" for four years? They obtained more actual machine work in college, and ran the tools themselves.

In Chicago is another very large shop, run by a western road—a "closed day-rate" shop—no piece work. Special apprentices as well as regulars enter this shop; are assigned to a certain gang machinist (if on the floor) or lathe, generally a bolt lathe first. In less than a week they will be running that machine under the supervision of an apprentice instructor having been first broken in by the apprentice who preceded them. And so it goes in every department; they are taken right in hand, and lay off shoes and wedges, set valves, hang link motions and so forth, and do it themselves, as well as the machinist who taught them. They are moved from one job to another, getting a real chance to learn, with the result that they know tools at least, and can step into a foreman's position with the assurance that they at least know what the men under them are doing. This particular shop has a three-year course for specials and four for regulars. Three years in a day shop is enough, but four, or even six in a piece-work shop does not equal it in many cases.

Follow along with the men who have "stuck" through the apprentice course. The percentage who finish in the day-rate shop is generally smaller by far than in the piece-work shop. This at the start is a big advantage, both to them and the company, for the very reason that the work they *personally* do is real hard work, as hard and exacting as the work of the men they work under; they are not mere helpers and observers, but

workers in every sense of the word. It is this hard work that weeds out the "collar and cuff" crowd who would rather sit at a desk and "push a pen" than get greasy and dirty. This class is weeded out in the first two or three months and no one is the loser. Then there is the ambitious few who have served, say two years of their time; they do their work well and are well liked. Some go home on vacations, or go here and there on business for the company and meet men, fellow classmates of theirs who are in industrial lines. These men are making, on an average, *more than twice as much* as the railroad man is, are being steadily advanced, and have an assured success before them. Yet they left college at the same time as the railroad apprentice, who still has one or two more years before him at a laborer's wage! What is the result? Is it any wonder that 50 per cent. quit at the first opportunity and go into other fields? Can they be blamed? The railroads, however, seem content to let this big majority go by after training them for so long. No inducements are held out—they don't seem to think it is capital gone to waste.

The way to hold these men is to cut the apprentice course for them to two years. Any man who is a graduate mechanical engineer, if he is any good at all, can with the right system get all that is necessary out of the shops in two years. Yet the Union Pacific is the only road to my knowledge that has realized and profited by this fact. There are men (and you can see them every day) in one of our big piece-work shops in Pennsylvania, both special and regular apprentices, who have served their four years, yet cannot swing a hammer properly or chip out a stud; they can be seen standing at a bench in the shop practically "pushing" the hammer, and this after four years training.

To get back to the subject, the few men who finish their time in the day shops are at once made machinists, and after two or three months more are made assistant roundhouse foremen, assigned to special duty or some similar position paying from $100 to $125 a month. Four years in college and three or four

more in the shops; seven or eight all told. They, after all these years of preparation, are getting as much as a good bookkeeper, clerk or draftsman who in many cases stepped into these positions right out of high school, or after a few months of business college. They have a bank account, and are bringing up families, while the prepared college man is only earning a few cents an hour.

One road makes a specialty of turning its "shop graduates" into the test department, where they don't get even as much as the machinists in the shops. After eight years of study and preparation they can get more for their muscle than for their brains! They are given work far beneath their capabilities; odd drafting jobs, computing and tabulating road tests, shop tests, etc., things that wouldn't tax the mind of a high school graduate; things that are not even worth the salaries they are paid. Yet they are kept on the pay roll, thrown a sop in the form of a title, and so it goes.

I have pointed out the faults—what is the remedy? Simply this: If you do have an apprentice course for college graduates, make it for *two years*—no more. Have special instructors and machines for your apprentices, make them work *all* the time they are on bench, machine, floor, and in the roundhouse, and get all there is to be gotten out of it. See that they are able to run their lathes, planers, shapers, etc., themselves, have them turn out work and compete with the other machinists. A schedule as follows would be ample for all purposes and would, with proper supervision by competent instructors, accomplish more in two years than the present system in some shops does in four. Bench work, 3 months; machines, 6 months; floor, 9 months; roundhouse, 3 months; special work, 3 months; total, 2 years.

Under special work would come dynamometer car, test work, drafting, etc. Some roads require boiler shop, but unless a man is to be employed there later as an assistant foreman, one month should suffice. Some roads require no work in the boiler shop at all.

One other thing—give them a fair living wage; some roads do, but the majority do not. The pay is usually from 15 cents to 20 cents an hour the first year and from 20 cents to 30 cents the last. The result is that two thirds have to have additional funds from home.

Give a course of two years properly conducted, make the men earn their money and pay them what they earn; and make them work *after* their course is completed as well, increasing their pay accordingly, and the railroads will be in dollars and cents on one hand and build up a force of executives on the other that will stick and return a hundred fold what the company has spent on their education and preparation.

RAILROADS AND COLLEGE MEN; THE EDITOR'S REPLY.

A correspondent, whose letter is printed in this issue, gives his ideas of the reasons why so few college trained men remain on the railroads. While what he has to say may be true in many cases, does the whole fault lie with the railroads?

The colleges have a responsibility in this connection which should not be overlooked. Are they generally accepting it and supplying the kind of training that will permit their graduates to enter the railroad field with as good an equipment as is supplied for other fields of endeavor? So far as the mechanical department is concerned, and it is particularly this department that our correspondent refers to, the indications are that with but two notable exceptions in the United States and possibly one in Canada, the colleges where mechanical engineering is taught at all are making but slight effort to give their students the kind of training that will prepare them to compete on the railroads with men of similar mental caliber who have come up through the ranks. To be sure, the graduate's personality enters very materially into the question and it is difficult to make comparisons, but the result of an examination of the college trained men who have made distinct successes in the mechanical department will show so great a predominance in favor of a few colleges where more or less special attention has been given to a preparation for railroad work, that the in-

dications are conclusive that such a preparation gives the man a decided advantage. It is by no means certain that a special training, confined exclusively to railroad subjects, is the best for the future success of the graduate, but instruction in how to apply engineering principles to the solution of the peculiar and special problems met with in locomotive and car design, operation and repair, appears to be sadly lacking in most mechanical engineering courses. A college would be failing in its duty if it gave the degree of mechanical engineer with a training in the application of engineering principles to the railroad or any other single field. On the other hand, it is equally failing in its duty to the railroads of this country if it gives its students no opportunity of learning how to apply the same principles to railroad problems as well as those found in stationary practice, the electrical field, or general manufacturing. The railroads need college trained engineers and no one realizes that better than the responsible officers in the various departments. But is it surprising in view of the experience of the past, that they cannot see their way clear to make any special inducement to them? There is no field which at the present time offers a more attractive future to a properly trained mechanical engineer who has suitable personal characteristics and a sound character than will be found in the mechanical departments of our railways. To be sure, they will have a much harder path to follow than they probably should have, due to the disappointing experience with their predecessors, but those who have the stamina to overcome the obstacles and the ability to make up for the shortcomings in their training while in college in case they are unfortunate enough to come from those colleges which are weak in this regard, will find that the reward is well worth striving for and at thirty or thirty-five years of age they will be commanding a larger salary and be in a much better position than their classmates who, in other lines of work, seemed to be far above them at twenty-five.

COUNCIL ACTIONS.

By letter ballot, dated January 15, the Council elected the following to membership. (*Individuals*) Messrs. J. M. Bell, Randle C. Carpenter, G. A. Chaney, M. A. Charavay, H. R. Codwise, N. W. Dougherty, J. A. Ely, I. W. Fisk, S. G. George, H. V. Gummere, J. A. Hall, J. M. Henderson, G. P. Hitchcock, G. L. Hosmer, Hale Houston, A. P. Little, S. L. Macdonald, H. D. McMurtray, W. L. Miser, J. R. Nelson, P. C. Nugent, C. T. Olmsted, R. A. Pearson, G. H. Radebaugh, P. L. Reed, John E. Robertson, A. E. Salazar, L. F. Seaton, T. C. Shedd, R. H. Skelton, Richard R. Smith, Wm. G. Smith, L. C. Starkey, W. B. Stelzner, C. H. Sutherland, R. E. Thompson, Wilbur M. Wilson, J. W. Winter and S. S. Yates. (*Institutions*) Drexel Institute, State University of Iowa and University of Nebraska. See pages *11, 12* and *13* of the January BULLETIN. The following applications, received after the January BULLETIN went to press, were also acted upon favorably.

BELLIS, A. E., Professor of Physics, University of Wyoming, Laramie, Wyo. 1914

HOWER, H. S., Associate Professor of Physics, Carnegie Institute of Technology, Pittsburgh, Pa 1914

JEWETT, F. B., Assistant Chief Engineer, Western Electric Co., 463 West St., New York, N. Y. 1914

LUTHER, H. B., Instructor in Civil Engineering, Massachusetts Institute of Technology, Boston, Mass. 1914

TABOR, WM. H., Instructor in Machine Shop Practice, Pennsylvania State College, State College, Pa. 1914

THOMAS, FRANKLIN, Associate Professor of Civil Engineering, Throop College of Technology, Pasadena, Calif. 1914

WALES, R. L., Professor of Mechanical Engineering and Dean of Engineering Dept., Rhode Island State College, Kingston, R. I. 1914

ZERN, EDW. N., Professor of Mining Engineering, West Virginia University, Morgantown, W. Va. 1914

APPLICANTS FOR MEMBERSHIP.

INDIVIDUALS.

(Applications received to Jan. 23, only.)

BOARDMAN, H. P., Professor of Civil Engineering, University of Nevada, Reno, Nev. 1914

BROWN, A. I., Instructor in Mechanical Engineering, The Ohio State University, Columbus, O. 1914

BROWN, (MRS.) KATHERINE D., Assistant Professor of Mathematics, Drexel Institute, Philadelphia, Pa. 1914

CLAPP, W. H., Assistant Professor of Steam Engineering and Machine Design, Throop College of Technology, Pasadena, Calif. 1914

COCKBURN, J. R., Assistant Professor of Descriptive Geometry, University of Toronto, Toronto, Ont., Can. 1914

EATON, J. S., Instructor in Mechanical Practice, University of Vermont, Burlington, Vt. 1914

GEORGE, R. D., Professor of Geology and State Geologist of Colorado, University of Colorado, Boulder, Colo. 1914

GUTHE, K. E., Professor of Physics and Dean of the Graduate Department, University of Michigan, Ann Arbor, Mich. 1914

HAM, WM. R., Professor of Physics, Pennsylvania State College, State College, Pa. 1914

HASKELL, F. E., Head of the Electrical Engineering Dept., Mechanics Institute, Rochester, N. Y. 1914

HOEXTER, S. J., Instructor, Dept. of Engineering, University of Michigan, Ann Arbor, Mich. 1914

LEONARD, L. R., Instructor in Electrical Engineering, University of Colorado, Boulder, Colo. 1914

LYLE, WM. T., Professor of Municipal Engineering, Lafayette College, Easton, Pa. 1914

NAIDU, R. S., Manager and Head Accountant, Engineer's Office, Vizayanagaram City, Madras, South India 1914

POND, G. G., Dean of the School of Natural Science, The Pennsylvania State College, State College, Pa. 1914

PRITCHARD, S. R., Professor of Electrical Engineering, Virginia Polytechnic Institute, Blacksburg, Va. 1914

ROYS, F. W., Instructor in Mechanical Engineering, Worcester Polytechnic Institute, Worcester, Mass. 1914

SPERRY, C. S., Instructor in Mathematics, Dept. of Engineering, University of Colorado, Boulder, Colo. 1914

INSTITUTIONS.

UNIVERSITY OF MISSOURI, Columbia, Mo., A. Ross Hill, President. 1914

THE PENNSYLVANIA STATE COLLEGE, State College, Pa., Edwin E. Sparks, President 1914

UNIVERSITY OF PENNSYLVANIA, Philadelphia, Pa., Edgar F. Smith, Provost 1914
PRINCETON UNIVERSITY, Princeton, N. J., John G. Hibben, President 1914
UNIVERSITY OF SOUTH CAROLINA, Columbia, S. C., S. C. Mitchell, President 1914
TUFTS COLLEGE, Tufts College, Mass., Wm. L. Hooper, President. 1914
THE UNIVERSITY OF WISCONSIN, Madison, Wis., Chas. R. Van Hise, President 1914

THE TREASURER'S MID-YEAR APPROXIMATE STATEMENT.

	Jan. 9, 1914	Jan. 15, 1913.
Received to date, for current dues	$2,836.00	$2,976.00
Received to date, for back dues	376.60	170.00
Received to date, from other sources	1,011.41	1,272.28
	$4,224.01	$4,418.28
Cash on hand, June 18, 1913, and June 17, 1912, resp.	1,763.26	2,194.01
	$5,987.27	$6,612.29
Paid out to date	4,693.85	$4,434.82
Balance on hand	$1,293.42	$2,177.47
Current dues outstanding	$2,384.00	$1,464.00
Back dues outstanding	693.00	486.04
Due from members and non-members for publications and advertising	316.03	234.34
Total	$3,393.03	$2,184.38

THE SECRETARY'S WESTERN TRIP.

The Secretary utilized a recent editorial tour of several thousand miles, to meet a number of leaders in Society matters. His experience bore out the statements made last month by Dean Anthony in the account of the latter's October tour. The itinerary included a number of educational centers, notably Cleveland, LaFayette, Chicago, Urbana, St. Louis, Columbia, Lawrence, Lincoln, Ames, Iowa City, Minneapolis and Madison.

At Case School, on the occasion of a visit made by the Secretary earlier in the year, President Howe had arranged a

luncheon for several members of the faculty and later a meeting of practically all of the local members. The work of the Society was discussed and a suggestion for a sectional organization disapproved. President Howe volunteered, however, to call a meeting at his residence for the discussion of Society papers in the hope that several such semi-social gatherings might be held during the winter. On the present trip the secretary found Cleveland in the grip of a severe blizzard (November 11) and he contented himself with calls on most of the faculty members. At Purdue many members of the Society were interviewed and the matter of institutional membership was taken up with Dean Benjamin, President Stone being away. LaFayette was suffering from an epidemic of diphtheria which, however, had not affected the university seriously.

In Chicago the Armour Institute was visited and institutional membership was discussed with the deans and stimulation of Society interest with the local members. A call was made on Professor Kinsley at the University of Chicago. At the University of Illinois the plan of institutional membership was explained to President James and many local members were met. This is, of course, one of the strongest Society centers. At Washington University several members of the faculty were visited and downtown a brief call on Mr. Einstein was made.

Thanksgiving and the day preceding were spent at the University of Missouri where there were many topics of Society interest to be discussed with Professors Hedrick, Hibbard, Fessenden and others. President Hill was abroad so could not discuss institutional membership at the time. The balance of the Thanksgiving recess found the Secretary at Lawrence where a great batch of S. P. E. E. mail had to be disposed of with Professor Shaad's coöperation. On Saturday evening Dean and Mrs. Walker gave a delightful dinner party to the local members, which was attended also by Chancellor Strong. As the University of Kansas was one of the first institutional members, this topic did not require attention.

In Lincoln, Dean Stout and Professor Chatburn had arranged a lunch at the Commercial Club, attended by forty or more S. P. E. E. members or adherents, including Chancellor Avery and prominent business men. Short talks were made by several men who expressed appreciation of the Society's work. A larger meeting of the local engineering society in the evening gave the Secretary an opportunity to discuss engineering matters with students and faculty. At Ames, President Pearson and his colleagues expressed great interest in the Society. The college and the president were enrolled as members and gatherings of students were addressed morning and evening.

At Iowa City, Dean Raymond gathered leading members of the faculty for lunch at the new Jefferson Hotel and made many excellent suggestions for stimulating Society interest. The new physics building, among others, was inspected and in the evening President Bowman and others were met at the Triangle Club. Several days were spent at Minneapolis where the scenes of the recent convention were pleasantly recalled. Dean Shenehon was most courteous in arranging for interviews with the president and other prominent local men. In his company a banquet of the local civic association was attended. A call on Professor Haynes was a pleasant event in Minneapolis.

The trip ended educationally at Madison where, in conversation with Dean Turneaure and President Van Hise, the successful Madison meeting was reviewed and the scenes of the several events recalled. The president expressed approval of the new grade of membership.

The secretary takes this opportunity to express his appreciation of the hospitality extended and his delight at the hearty interest in the work of the Society everywhere manifested.

THE COMMITTEE ON SECONDARY SCHOOLS.

Professor H. T. Clifton, chairman of the committee, has laid out the following tentative program. He suggests that the committee undertake several lines of activity, all of which have for their aim a closer relation between the engineering colleges and the technical high schools. These are:

1. An endeavor, in coöperation with the Secretary's office, to interest more high-school teachers in joining the Society.

2. A campaign of education in favor of recognition of elementary high-school work in subjects not usually regarded as preparatory: for example (subject to revision), mechanical drawing, shop mechanics, machine-shop practice, elementary plane surveying, technical arithmetic, elements of strength of materials and bookkeeping.

3. The tentative formulation of courses in these subjects under the advice of college and high-school instructors.

4. A more careful analysis of the traditional high-school studies; algebra, geometry, and trigonometry, with reference to the elimination of unnecessary matter.

On these items, he writes the members of the committee as follows:

"1. We might arrange for a wide distribution among high-school teachers of the circulars and application blanks of the Society. I believe that the Secretary would extend the use of his office to us for this purpose, and that we need chiefly to get the names.

"But the interest of most high-school teachers will be in the BULLETIN. I wish we might, for a beginning, arrange for articles on high-school matters by high-school and college men.

"2, 3. The 1912 Report on Entrance Requirements is admirable in its breadth. It needs a wide circulation among technical high schools. But the formulation of courses should not stop at college entrance requirements. It is my experience that technical high schools of the country are quite far apart

on courses which have not been standardized for them in schools of older type. Our society would furnish an admirable medium for the interchange of views under the criticism of practical engineers.

"We would need to go outside the present membership of the Society for information and for experiment. I would imagine that interest in the Society might in this way be aroused among the high-school contingent.

"4. I feel that a great deal of the time spent on mathematics courses of the older style was wasted. The national algebra and geometry syllabuses are very fair, but they are permeated with the idea that the juggling of expressions and figures are worth while. I wish we might take, or have some one take, a standard engineering text of some sort and see what algebraic processes are required, and what degree of difficulty is presented. The matter of formulation of courses would have to take the form of a much-dreaded questionnaire, or rather two of them. I have one or two such in mind, covering the general question of the practicability of elementary courses in applied sciences."

TENTATIVE PROGRAM OF THE PRINCETON MEETING.

Monday Afternoon.

Meeting of the Council.
Addresses of Welcome by Governor Fielder, President Hibben, Mayor (Professor) Phillips and response by Dean Anthony.
Reports of officers and committees.
Meeting of delegates of institutional members.

Monday Evening.

Smoker.

Tuesday Morning.

Council meeting.
Session under the Auspices of the Committee on College Administration, Dean F. L. Bishop, Chairman.

TUESDAY AFTERNOON.

Reports of committees.
Committee dinners at which the chairman of each committee will preside for the purpose of leading in the informal discussion of topics opened up in the previous discussion.

TUESDAY EVENING.

Lecture dealing with recent advances in one or more branches of science.

WEDNESDAY MORNING.

Council meeting.
Session under the auspices of Dean Herman Schneider devoted to the subject of coöperative education from the employer's point of view.

WEDNESDAY AFTERNOON.

Contributed papers.
Meeting of delegates of institutional members.

WEDNESDAY EVENING.

Annual dinner.
Presidential address.

THURSDAY MORNING.

Council meeting.
Election of officers and members of council.
Reports of convention committees.
Contributed papers.
Adjournment.

THURSDAY AFTERNOON.

Meeting of 1914–15 council.

LETTERS TO THE EDITOR.

SECRETARY, S. P. E. E.

Dear Sir: I notice that in the discussion of the "Shop Work at the University of Minnesota," Professor Meeker of Iowa State College says, in effect, that he cannot judge whether a man will make an engineer or not from the class of work he does in school. It would be very interesting to know what Professor Meeker's explanation of the man's success is and whether the man himself thinks that the education he got at

I. S. C. contributed to his success or not, and if not what did. We have teachers in the secondary schools proposing to guide students into the vocations for which they are fitted, yet the men who propose to do this have no special training in the lines to which they expect to guide students. Here is a man with many years experience in training men for mechanical engineering who says he cannot tell whether the men are fitted to be engineers or not. What is the answer? Is vocational guidance impossible or has our education so little relation to engineering work that success in one does not indicate success in the other?

Sincerely yours,

GEO. L. SULLIVAN.

SANTA CLARA, CALIF.

SECRETARY, S. P. E. E.

Dear Sir: In my experience at the Westinghouse Electric & Manufacturing Co. with technical graduates, I came to the conclusion that for some reason or other very few of them obtain a concept of power factor, and as a result I examined twenty-five young men from the leading technical institutions now in our graduate student course with the following results:

Number of papers.....25
Answers all right..... 3 = 12 per cent.
Method right but wrong answer..... 4 = 16 per cent.
Average time in course..... 6.1 mos.

No. 1. A 1000:100-volt transformer carries 100 k.v.a. at 70 per cent. power factor. What are the H.T. and L.T. currents?

Right 100 and 1,000 amps.....17 = 68 per cent.
Wrong 143 and 1,428..... 5 = 20 per cent.
70 and 700..... 3 = 12 per cent. 8 = 32 per cent.

No. 2. A synchronous motor is to be used to raise the power factor of a transmission line supplying an induction motor load. Should it be placed at the generating or receiving end of the line?

Generating end ..... 5 = 20 per cent.
Receiving end .....19 = 76 per cent.
Either end ..... 1 = 4 per cent.

Should its field be over- or under-excited.

Over-excited .....21 = 84 per cent.
Under-excited ..... 4 = 16 per cent.

No. 3. A line supplies two induction motors. One requires 100 k.v.a. at 60 per cent. power factor, the other 200 k.v.a. at 80 per cent. What is the total load in k.v.a.?

Right 297.3 k.v.a..... 4 = 16 per cent.
Wrong but right method..... 4 = 16 per cent.
100 k.v.a. + 200 k.v.a. = 300 k.v.a...13 = 52 per cent.

What is its power factor?

Right 74 per cent..... 5 = 20 per cent.
Wrong, right method..... 4 = 16 per cent.
$\frac{100 \times .60 + 200 \times .90}{100 + 200} = 73.3$ per cent. 10 = 40 per cent.
Other results ..... 6 = 24 per cent.

If you consider this of sufficient importance, you may print it in the S. P. E. E. BULLETIN.

Very truly yours,

J. H. MUSTARD.

PITTSBURGH, PA.

SECRETARY, S. P. E. E.

Dear Sir: Your journal may be interested to learn that I am undertaking a vocational and educational survey preliminary to the establishment of the Isaac Delgado Central Trades School for boys in New Orleans. For this school Mr. Delgado has bequeathed nearly a million dollars. I am sending you some of the blanks which I am using in making this survey. I would be grateful for any constructive suggestions or information along this line.

At the moment I am interested in securing suggestions, typical plans, etc., of buildings for trade schools.

Thanking you in advance, I am,

Yours truly,

DAVID L. HILL,
Director.

NEW ORLEANS, LA.

Editor's Note.—Director Hill sends with his letter copies of a number of forms for use in the vocational and educational survey which is being made for the Isaac Delgado Central Trades School. The forms are as follows:

1. Individual Study: School History of Children out of School.
2. Individual Study: Economic and Home Conditions of Children out of School.
3. Thirteen-year-old Boy in School.
4. Industries and Vocational Education.
5. Individual Study: Wage Earners in Industries.

BOOK REVIEWS.

"Forgecraft." By CHARLES PHILIP CROWE, Ohio State University. Published by R. G. Adams & Co., Columbus, Ohio. 175 6 × 9 in. pages.

The first part of this book is devoted to simple forging exercises such as are used in most of the technical institutions. It gives instructions for making the various shapes of forge tools together with the dimensions and materials to be used. It also treats of the welding of wrought iron and steel with instructions for preserving the strength of the materials. In Part 2, welding is described and illustrated as well as can be expected, as that part of forge work can only be gained from practical experience. The colors of heats and appearance of metal can only be learned at the forge. The different methods of welding—electric, thermit, oxyhydrogen, and oxyacetylene, as well as the comparative costs of the different methods, and of the strengths of welds produced, are explained. In Part 3 of the book, standard cutting-tools, common in machine shops,

are shown, with instructions for forging and shaping them for the work for which they are to be used. The process of hardening and tempering is of such great importance that the author has devoted much space to this branch of his work and he explains as far as possible the color of heats and the appearance of the metals treated. The last chapters of the book are devoted to the heat treatment of steel and the furnaces most commonly used, cooling baths and their effect on different carbon and alloy steels, carbonizing materials, heats and methods of packing. That the author understands his subject is shown by the way he explains the theory as well as the practical application.

The book contains 78 illustrations and a number of tables for guides in tempering and work connected with forge practice. It can be recommended as a good text-book for students in technical schools and colleges.

WM. W. BIRD.

Heat Engines. By WILLIAM RIPPER, D.Eng. (Sheffield), Hon.D.Sc.Eng. (Bristol), Professor of Engineering at the University of Sheffield. Longmans, Green and Co., New York. $5 \times 7\frac{1}{2}$ in.; x + 352 pp.; 235 illustrations. $1.10 net.

This book, which is not to be confused with the more advanced work entitled "Steam Engine Theory and Practice" by the same author, originally appeared as "Steam" in 1889, was changed to the present title in 1909, and after repeated revision reached its fourteenth printing in 1913. The new edition contains additions to the text and a number of new illustrations.

The author states that his purpose was to write an introductory text-book for engineering students, more especially those having some practical acquaintance with the manufacture or use of steam machinery, but giving particular attention to the principles upon which steam-engine and boiler efficiency and economy depend. He seems to have satisfactorily accomplished his purpose.

The treatment is quite elementary and presupposes but little

knowledge of physics and chemistry and none of higher mathematics. It is not sufficiently advanced to meet the requirements of the usual college course in this subject, but may be suitable for extension work, night schools, and similar courses of an elementary and practical character.

Twenty-eight pages are devoted to heat in general, sixteen to the generation and properties of steam, and twenty-eight to expansion working. The remainder of the book discusses the steam engine (general), valve gears, cranks, condensers, governors, the indicator, compound engines, boilers, the furnace, steam generation, combustion, practical notes on the care and management of engines and boilers, steam turbines, internal combustion engines and an appendix contains questions, exercises and answers.

WM. N. BARNARD.

Laboratory Manual, Direct and Alternating Current. By CLARENCE E. CLEWELL, Yale University. Published by the author, New Haven, Conn. viii + 100 6 × 9 in. pp. $1.00 list price.

Mr. Clewell has prepared a simple manual for the use of students beginning the study of electrical engineering. It is designed especially to accompany Timbie's Elements of Electricity, to which frequent reference is made, and for students specializing in courses other than electrical engineering. It is not intended as a text, that is to furnish the fundamental facts but, as the name implies, it is a hand-book to guide the students in their laboratory exercises. The plan followed is simple and systematic. The same general scheme is used in all exercises. It is as follows: An introductory paragraph states the purpose of the exercise and this is followed by a brief outline of the theory of operation of the apparatus to be studied. A statement of the source of power supply is made and a list of pieces of apparatus is given. Next the order of work is outlined and illustrated with forms for the tabulating of data and connection diagrams. Finally there is an outline of the expected report. All of this is done briefly as is evident from

the fact that thirty experiments are covered in a hundred pages. The author has tried out the text in the classes for which they were primarily prepared and finds the results satisfactory.

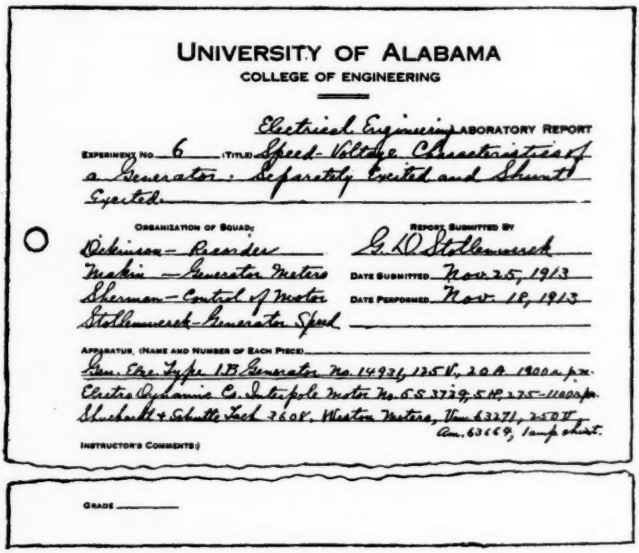
H. H. NORRIS.

QUESTIONS AND KINKS.

LABORATORY REPORT TITLE SHEETS.

The electrical engineering department of the University of Alabama has lately adopted a form of title sheet like the sample shown.

There is an advantage to the student in being trained to use system in his work. Title sheets as such need no com-



UNIVERSITY OF ALABAMA
COLLEGE OF ENGINEERING

Electrical Engineering LABORATORY REPORT

EXPERIMENT NO. 6 (TITLE) Speed-Voltage Characteristics of a Generator - Separately Excited and Shunt Excited.

ORGANIZATION OF SQUAD:
Dickinson - Recorder
Makin - Generator Meters
Sherman - Control of Motor
Stoltenmeyer - Generator Speed

REPORT SUBMITTED BY
G. O. Stoltenmeyer

DATE SUBMITTED Nov. 25, 1913
DATE PERFORMED Nov. 18, 1913

APPARATUS, (NAME AND NUMBER OF EACH PIECE)
Gen. Elec. Type I.B. Generator No. 149316, 125 V, 20 A, 1800 r.p.m.
Electro Dynamic Co. Interpole Motor No. 6S 3729, 5 H.P. 225-1100 r.p.m.
Shuchardt & Schutte Tach. 2608, Weston Meters, Vm. 63271, 250 V.
Am. 63669, 1 amp. shunt.

INSTRUCTOR'S COMMENTS:

GRADE _____

ment, but if system is a good thing, there is something to be said in favor of system between departments, as well as within departments. Further, in a small institution, the matter of a multiplicity of stationery is to be considered.

The point in these title sheets of which we think particularly well is the item "Organization of Squad," a matter on which stress is laid in some institutions, but not as commonly as it should be for the students' welfare. Observation in a number of different colleges shows that the majority of engineering students come to the engineering laboratories with very little conception of what is meant by "team-work." While athletic sports are valuable as a means of inculcating that very desirable spirit, the engineering laboratory is usually the first place, in the student's academic career, in which the results depend on the collaboration of several individuals, rather than on the work of one individual acting independently. Hence the laboratory should be utilized to train him in working well with his colleagues. The title sheet of the reports should suggest coöperation.

GUSTAV WITTIG.

OTHER SOCIETIES.

A recent issue of the New York *Press* contains an account of the work of the National Association of Corporation Schools and of the educational work of the New York Edison Company. Mr. F. C. Henderschott, manager of the Bureau of Education of the New York Edison Company, was active in the formation in the National Association.

On account of conflict with the dates of a large medical convention at Atlantic City, the American Society for Testing Materials has been obliged to schedule its convention for one week later than was intended, thus bringing it into conflict with the tentative dates selected for the S. P. E. E. meeting.

Plans are already well under way for one or more special

trains from the east to San Francisco in connection with the International Electrical Congress to be held in that city in September, 1915. The tentative program includes a round trip of about 30 days' duration with stops in Chicago, Colorado Springs, Salt Lake City, San Francisco, Santa Barbara and Los Angeles. At each one of these places, special arrangements will be made by local committees for the comfort and entertainment of the members of the party. Other features of the trip will be the Royal Gorge, the Feather River Canyon, and a four-day visit to the Yellowstone National Park on the way out, with a 24-hour stop at the Grand Canyon on the way home. Should the demand justify it, a special train will also be provided from Chicago straight through to San Francisco to take care of those with whom time is a prime consideration. The transportation committee of the Congress is further considering the possibilities of marine transportation by way of the Panama Canal. There appears to be a considerable demand for this, especially if satisfactory arrangements can be made for combining the land and water features.

PUBLICATIONS RECEIVED.

The University of Chicago Press announces that the subscriptions to Vol. III of the "Annual Table of Constants and Numerical Data, Chemical, Physical and Technological," published by the International Commission of the Seventh and Eighth International Congresses of Applied Chemistry, now in press, will be closed March 31, 1914. The subscription will be $6.00 for unbound copies and $6.80 for bound copies, prepaid. Members of the National Academy of Science, The American Academy of Arts and Sciences, The American Chemical Society and the Society of Chemical Industry will receive the volumes for $4.80 and $5.60 respectively if their subscriptions are received by March 31.

Dr. Harold Pender and Dr. R. L. Jones have reprinted from the *Physical Review* the latter's thesis on the "*Effect of Heat and Magnetization on the Magnetic Properties of Steel.*"

A recent number of *Contributions from the Physical Laboratory of the State University of Iowa* contains a well-illustrated description of the fine new physical laboratory, written by Professor G. W. Stewart, head of the department of physics.

PUBLICATIONS RECEIVED.

The Dartmouth College Bulletin, No. 3, is the annual for 1913 of the Thayer School of Engineering and of the Thayer Society of Engineers of Dartmouth College. It contains a wealth of information regarding alumni and the Society.

The University of Nevada Sagebrush, the weekly newspaper published by the students, in a recent issue, contains an account of the Northwestern Power Company's new plant on the White Salmon River. It is mentioned here because it shows an increasing tendency to give attention to the interests of engineers in college publications.

The Throop College Bulletin, Vol. XXII, No. 61, contains an address on "*Industrial Research*" by President A. D. Little, of the American Chemical Society.

The Bulletin of the Virginia Polytechnic Institute, Vol. VI, No. 4, contains a biographical sketch of the new president, Joseph D. Eggleston. The frontispiece is an excellent portrait of the president.

The Pennsylvania Railroad has republished a review written for the Economic Journal by W. M. Acworth of W. Z. Ripley's book "*Rates and Regulations.*"

The Iowa Engineer for December, among other excellent articles, contains one on "Training Highway Engineers at Iowa State College," by Professor T. R. Agg. An outline of the first annual short course for road builders is also given. In the November number is an article by Professor J. B. Davidson on the "Application of Power to Agriculture" and a short discussion on "The Use of the Slide Rule in Engineering Calculation," by Professor H. C. Bartholomew.

The University of Queensland has published a 160-page manual of public examinations for the years 1913 and 1914.

Psychological Aspects of the Problem of Atmospheric Smoke Pollution is the title of Bulletin No. 3 of the Mellon Institute affiliated with the University of Pittsburgh. Among other data it gives statistics of sunshine in a number of cities.

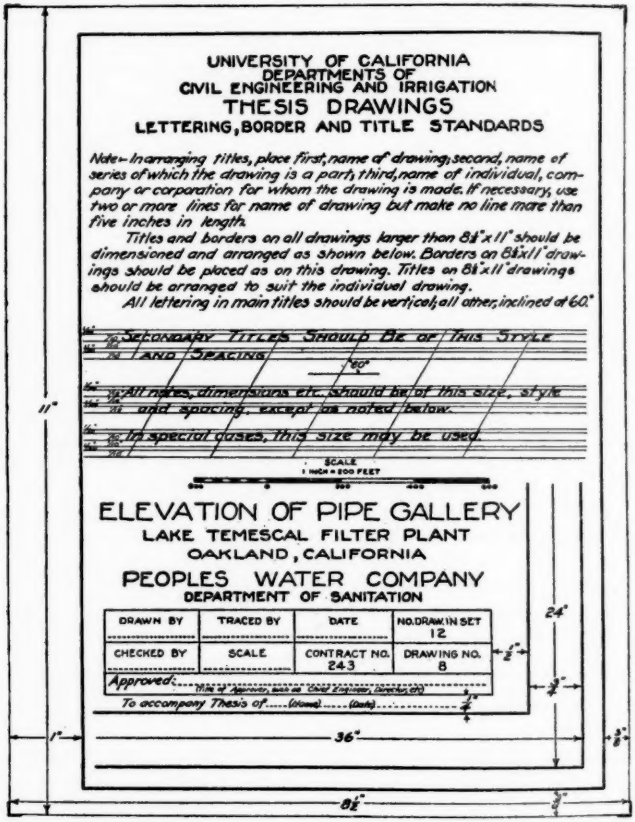
The Harvard Engineering Journal, Vol. XII, No. 3, contains an account of a recent inspection trip by sanitary engineering students, a contribution on mechanics by the late Dean C. M. Woodward, Harvard, '60, and information regarding the alumni and college activities.

Die geistigen Mittel des technischen Fortschrittes in den Vereinigten Staaten von Amerika is the title of a reprint of the report made by Mr. Carl Matschoss based on his studies of technical schools in America made during 1912. The report is very complete.

The Stute published by the students of the Stevens Institute of Technology makes a special feature of accounts of the inspection trips taken to important engineering works. The processes inspected are so fully de-

scribed that the students who are not fortunate enough to be members of the inspection parties can secure part of the benefit derived.

The Technograph, published quarterly by the engineering societies of the University of Illinois, contains in the last issue a helpful symposium


UNIVERSITY OF CALIFORNIA
DEPARTMENTS OF
CIVIL ENGINEERING AND IRRIGATION
THESIS DRAWINGS
LETTERING, BORDER AND TITLE STANDARDS
Note- In arranging titles, place first, name of drawing; second, name of series of which the drawing is a part; third, name of individual, company or corporation for whom the drawing is made. If necessary, use two or more lines for name of drawing but make no line more than five inches in length.
Titles and borders on all drawings larger than 8½"x11" should be dimensioned and arranged as shown below. Borders on 8½"x11" drawings should be placed as on this drawing. Titles on 8½"x11" drawings should be arranged to suit the individual drawing.
All lettering in main titles should be vertical; all other, inclined at 60°.
SECONDARY TITLES SHOULD BE OF THIS STYLE AND SPACING
All notes, dimensions etc. should be of this size, style and spacing, except as noted below.
In special cases, this size may be used.
SCALE
1 INCH = 200 FEET
ELEVATION OF PIPE GALLERY
LAKE TEMESCAL FILTER PLANT
OAKLAND, CALIFORNIA
PEOPLES WATER COMPANY
DEPARTMENT OF SANITATION
DRAWN BY
TRACED BY
DATE
NO. DRAWING IN SET
12
CHECKED BY
SCALE
CONTRACT NO.
243
DRAWING NO.
8
Approved:
To accompany Thesis of (name) (date)
11"
24"
36"
1"
8½"

on "*How to Study.*" The short articles are written by successful students in the university and are practical and at the same time they contain quite a little philosophy. Other college publications could do worse than to copy either the articles or the plan.

PUBLICATIONS RECEIVED.

The Index, printed and published by the printing department of the Columbus Trade School, is bringing out a number of short, standard compositions as well as notes of interest regarding the department's work. The December issue, attractively printed, contains Goldsmith's "Deserted Village."

The Item is a monthly magazine of very creditable make-up, edited and printed by the students of the Pasadena High School. It contains stu-

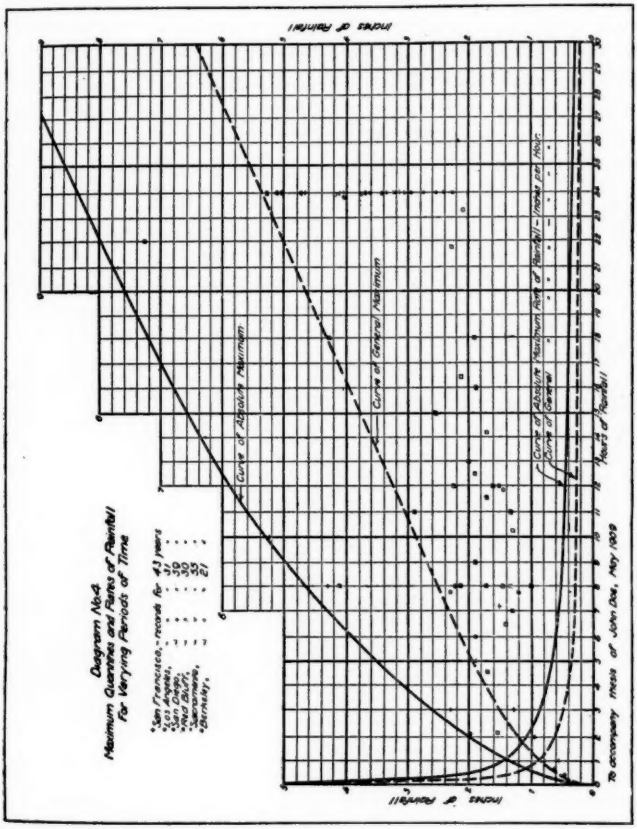


Diagram No 4
Maximum Quantities and Rates of Rainfall
For Varying Periods of Time
Curve of Absolute Maximum
Curve of General Maximum
Hours of Rainfall
Inches of Rainfall

UNIVERSITY OF CALIFORNIA. SAMPLE OF STYLE FOR THESIS DRAWINGS.

dent compositions of various kinds and covers the news of the school thoroughly. The October issue contained excellent pictures of the fine buildings which house the school.

Rules for Thesis Work, issued by the departments of civil engineering and irrigation of the University of California, is timely and suggestive. It contains not only rules but suggestions as to arrangement, rules of style, etc. The recommendations of a joint committee on engineering publications appointed by four national engineering societies are given, as well as the recommendations to authors prepared by the American Institute of Electrical Engineers. Plates showing styles of letters, sample curves, etc., are included. (See pp. *34* and *35*.)

PERSONAL NOTES.

Professor H. H. Stoek, head of the department of mining engineering at the University of Illinois, is taking active interest in the coal mining institute, in the application of safety appliances in mines and in vocational education in mining. He is also a member of the new committee on junior members and affiliated student societies of the American Institute of Mining Engineers.

Professor E. J. McCaustland, in charge of municipal and highway engineering at the University of Washington, Seattle, Wash., has been appointed consulting engineer for King County. The County is spending $3,000,000 for permanent highways.

Professor Morgan Brooks, of the University of Illinois, recently delivered an illustrated lecture on "Effective Lighting of Interiors" before the St. Louis section of the A. I. E. E. and the Engineers' Club of St. Louis. Professor Brooks is doing special research work in this line.

Professor A. H. Blanchard, of Columbia University, recently delivered an illustrated lecture on "Modern Developments in Highway Engineering" at the Drexel Institute in Philadelphia.

Mr. L. B. Taylor recently left the Allis-Chalmers Co., Milwaukee, Wis., to become an instructor in the mechanical and electrical engineering department of the University of Pennsylvania.

PERSONAL NOTES.

Mr. Guy W. Smith, formerly instructor in engineering mathematics at the University of Colorado, is now assistant in mathematics in the University of Illinois.

Mr. Lewis E. Moore, formerly assistant professor of civil engineering at the Massachusetts Institute of Technology, became, on January 1, engineer of bridges and signals for the Massachusetts Public Service Commission. His headquarters are 1 Beacon St., Boston, Mass.

Professor Hugo Diemer delivered a lecture on scientific management at the December meeting of the Engineer's Society of Northwestern Pennsylvania at Erie. The lecture was attended by many prominent manufacturers and business men who manifested much interest and took active part in the discussion which followed the lecture.

Mr. Earl B. Smith has resigned as a member of the engineering faculty of Drexel Institute to become connected with the U. S. Office of Public Roads, Washington, D. C., as Associate Mechanical Engineer.

Professor F. E. Ayer, of the University of Cincinnati, has been appointed dean of the Engineering College to be established in connection with the new Municipal University of Akron, Ohio.

Professor T. E. French, of the Ohio State University, has shown his interest in the Society by designing the handsome cover plate used on the January issue for the first time.

COLLEGE NEWS.

Brown University.—*The Boston Evening Transcript* of January 3, devotes a large space to an illustrated history of the University covering 150 years.—A course in industrial organization and scientific management will be given for the first time during the second semester of the present year. A feature of the course will be three or four lectures monthly by business men and efficiency experts. The first of these lectures, which will be open to the public, was given on Feb. 19 by Director H. S. Person on "Different Types of Management." The course is an outgrowth of the summer course in scientific management, the first of its kind in this country, which was conducted in Providence last summer by Professor J. Ansel Brooks, of Brown University, and Mr. Frank B. Gilbreth. The course was attended by professors of engineering and business men from California, Michigan, New York, Pennsylvania, Vermont and other states.

Case School of Applied Science.—Professor T. S. Ayres, who is on leave of absence from Purdue University, is acting head of the department of mechanics and is assisted by Mr. C. T. Olmsted, formerly instructor in civil engineering.—Mr. M. B. Greenough, Tufts '12, takes Mr. Olmsted's place. Mr. Greenough is conducting a new course in highway engineering in connection with which some new apparatus has been installed.—Messrs. G. L. Greves, Ill. ,13, and C. C. Dash, Purdue '11, have joined Professor H. B. Dates's electrical engineering staff.—The English and the modern language departments have one new instructor each, Messrs. C. M. Thurber, Cornell '08, and F. H. Adler, Ph.D., Ill. '13, respectively.

Clarkson College of Technology.—A new charter has been granted to the institution formerly known as the Clarkson School of Technology changing the name to Clarkson College

of Technology and giving the right to give graduate work and to grant appropriate degrees in addition to the regular bachelor degrees.

University of Colorado.—The work of the state oil inspector is being done very largely in the department of mechanical engineering. A laboratory has been fitted up in a small fireproof building at the rear of the engineering building for this purpose. The state law requires that all fuel oils be tested, but the character of the tests designated as well as the instruments specified are unsatisfactory, and to obtain information with a view to formulating a new law, an investigation of instruments and methods is being conducted. A meeting of all oil men of this region was held at the university on February 5 to consider the matter. The work is being done under the direction of Prof. J. A. Hunter, of the M. E. department.—Recently, a complete new lighting system was installed on the campus. Tungsten lamps in 12-in. globes mounted on short steel supports replace the old arc lamps which hung from high poles. The change was necessitated owing to the growth of trees interfering with the illumination from the arcs.—A cabinet containing a full-sized section of a slow sand filter was presented to the civil engineering department by the Denver Union Water Co., which also provided an expert to superintend its installation. The section, which is covered in front with glass panels, shows in detail the arrangement of the underdrains and of the filtering materials.

Columbia University.—The graduate course in highway engineering announced last month is arousing great interest. The University calls special attention to the Davis Library of Highway Engineering which is said to be the most complete collection of works on this and allied subjects in the country.

University of Illinois.—The annual inspection trip of the department of electrical engineering this year was divided into two sections. One visited the Keokuk water-power plant, while the other inspected the industries around Joliet, Ill.

The sections met in Chicago where the features were inspections of parts of the Commonwealth Edison system, The Hawthorne works of the Western Electric Company and the Illinois Steel works.—At a recent meeting of the trustees, Mr. R. Y. Williams was appointed director of the miners' and mechanics' institutes, which are to be established under the direction of the department of mining engineering. Authority for the establishment of these institutes was granted by an act of the State Legislature in 1911, but no appropriation was made to carry out the authorization until the latter part of the recent session of the Legislature, at which time an appropriation of $15,000 per annum was included in House Bill 895 (a bill for the ordinary and contingent expenses of the state government). The purpose of the miners' and mechanics' institutes is somewhat similar to that of the farmers' institutes, but their specific purpose is to assist men who are preparing themselves to pass the tests required by the state before they can hold official positions about the mines.—Prof. J. M. Bryant has recently been employed by Jacksonville, Kewanee and Lewistown, as consulting engineer in connection with municipal electric lighting work.—Mr. Francis S. Peabody, president of the Peabody Coal Company of Chicago, recently lectured before the college of engineering on "The Mining and Utilization of Illinois Coal." The lecture was illustrated with excellent motion pictures taken underground in actual coal mines, the first successful motion pictures taken underground.

Iowa State College.—The college successfully inaugurated its new winter engineering short courses from December 29, 1913, to January 9, 1914. The holiday vacation for the regular students of the college extends over this period and for a number of years the agricultural division has been conducting two-week agricultural short courses along agricultural lines, which have been attended each winter by several hundred farmers and others interested from all over the state. This winter the engineering division conducted similar short courses in highway engineering, road-making, cement and concrete,

power plants, steam engines, gas engines, applied electricity, and drainage. Further it operated a short course of five days for painters and decorators. In all there were two hundred students enrolled for the engineering short-course work of the college.

The course for highway engineers was conducted by the Iowa Highway Commission, which by law has its quarters at the college, and was in the nature of a conference of the commission with the county engineers and their assistants who have active charge of all road, culvert and bridge work of the state, on which probably nearly ten million dollars will be spent during the season of 1914. Eighty-seven men registered for this work which was followed by a two days' convention of all the county engineers of the state, who were ordered in for this purpose by the Highway Commission. The highway engineers' short course was along the same plan which is followed by some large corporations in calling together their field men for conference and study of their work for the following season. Among those who assisted in the instruction were the following: state engineer A. R. Hirst, Wisconsin, state engineer A. N. Johnson, Illinois, Dr. L. I. Hewes, engineer in charge highway economics, Office of Public Roads, Washington, D. C., T. R. Agg, professor of highway engineering, Iowa State College, and the staff of the Iowa State Highway Commission.

The instruction for the painters and decorators was given at the request of the Master Painters' Association of Iowa. Fifty-eight students were enrolled for the work. The instruction was given by Chas. Mollendorf, of the Chicago School of Painting, Decorating and Paper Hanging, and J. W. Luthe, of Cleveland, chairman of the educational committee of the Ohio Association of Master House Painters and Decorators. It is believed that this is the first real trade school short course ever conducted at a technical institution in this country.

University of Maine.—The civil engineering curriculum has this year been enlarged by three highway courses, the equiva-

lent of three semester-hours for one year. These embrace courses in municipal engineering, country roads and highways, and testing of road materials, as options for the senior civil engineering students.—A scheme of coöperation between the civil engineering department and the newly organized state highway commission has resulted in the establishment of a complete road-materials testing laboratory at the university, where tests for all materials of construction in the work of the commission will be performed by the department of civil engineering. Further, there is being developed a comprehensive plan of coöperation along highway engineering lines between the state highway department and the university.

Massachusetts Institute of Technology.—Professor T. E. Pope, of the department of chemistry, has retired and he will be followed shortly by Professor S. H. Woodbridge. President Maclaurin pays tribute to their work and influence in his recent report to the corporation.—Professors E. I. Williams and A. LeMonnier, now in charge of the department of architecture, have taken hold of their new duties with vigor and enthusiasm.—The registration shows a marked gain over last year which was the record year in this particular. The gain is greatest in chemistry and mechanical engineering and in the number of students from the south.—The alumni are manifesting great activity, as is evidenced by the work of the committees on student housing, Walker memorial, alumni fund, and business and engineering administration.—A school for health officers has been established in coöperation with Harvard University.

University of Nevada.—The Engineer's Club is making a special feature this winter of the use of moving-picture machines to illustrate electrical and other engineering pursuits. Professor Scrugham has collected some 32,000 ft. of film showing such subjects as "Electrical Education of the Thrifty Family," "What Is Behind the Electric Button?" "Welding Rails by the Goldschmidt-Thermit Process," etc.—The Mackay School of Mines is doing a large amount of sample-testing for

prospectors and others, including much work on uranium, vanadium and platinum. This is considered significant as most of the interest before this year has been in gold and silver ores.—The students recently voted down a proposition to place in the hands of a student committee the control of student activities, examinations and the enforcement of university regulations. They feared the effect of concentration of authority in the hands of a small student-committee.

The University of Pittsburgh announces an evening course in valuation and public utilities covering five months, with three sessions each week. An outline of the course has been printed.

Pratt Institute.—An inspection was recently made by the institute authorities of test fences painted under the auspices of the American Society for Testing Materials, with paints made by the students in the industrial chemistry laboratory. The paints were made under A.S.T.M. specifications.—Undergraduates and alumni have been active this winter in forming associations needed to foster loyalty to the institute. Students in the evening drawing classes, as well as other groups, have formed associations.—Recently Mr. P. S. Millar of the electrical testing laboratories gave a lecture on "interior illumination" using three small model rooms to give practical demonstrations of correct and incorrect illumination.

Rhode Island State College.—Mr. R. Martel replaces Mr. M. B. Greenough as instructor in civil engineering.—Science Hall is now completed and is fully equipped. The department of physics is undertaking research work for which facilities have been provided.

Stevens Institute of Technology.—A convention of Stevens men, lasting for two days, was inaugurated and managed by the Alumni Association. It proved so successful that hereafter it will be a regular feature of the Association's annual mid-winter activities. The Convention began on the after-

noon of Jan. 9, in the auditorium of the main building—the "Old Stone Mill"—with a symposium on "The Engineer's Part in the Regulation of Public Utilities." In view of the prominence of the speakers and the importance of the subject, the meeting was attended by a number of men not connected with the institute as well as by a large audience of alumni. After a preliminary address by President J. H. Cuntz of the Association, Dr. Humphreys opened the conference with a frank and emphatic statement of what the engineer's relation to public utilities could and should be. There were also addresses in the same vein but illustrating various points of view, by Newcomb Carlton, '90, vice-president W. U. Telegraph Co., John W. Lieb, '81, vice-president N. Y. Edison Co., George Gibbs, '82, consulting electrical engineer, Pennsylvania R. R., and James E. Sague, commissioner, Public Service Commission No. 2, State of N. Y.

On Saturday morning, January 10, delegates from the Brooklyn, Newark, Philadelphia, Wisconsin, Pittsburgh, Michigan, Schenectady, Southern, Western and New England Stevens Clubs assembled in the magnificent Alumni Room of Castle Stevens. The Far Eastern Club, somewhat deterred, in spite of its loyalty, by the distance between Japan and Hoboken, sent a report and congratulations. The European Club, equally loyal and almost as distant, was represented by proxy. The clubs formed a federation and adopted a flag designed by D. C. Johnson, '06, after the Stars and Stripes. There are twelve red and gray stripes each bearing the name of one of the twelve charter clubs. The field is blue dotted with twelve aces of clubs and has the word Stevens set diagonally across it. For every new club admitted to the Federation a new ace will be added to the field. After a short business meeting and a luncheon in the Castle, the visitors went to the Brooklyn Navy Yard in a special boat obtained through the courtesy of Lieut. Commander F. R. Harris, '96.

At the banquet which took place in the evening at the Hotel Astor, New York City, Col. George Harvey, editor of the *North American Review,* presented on behalf of the board of trustees

a life size portrait of Dr. Humphreys, painted by Mr. John W. Alexander, president of the National Academy of Design. It was formally accepted by Col. E. A. Stevens. The speakers were Mr. Alexander, Dr. James Mapes Dodge and Mr. A. G. Glasgow, '85.

Texas A. & M. College.—A recent issue of the *Battalion*, the weekly publication of the Students' Association, mentions the "awkward squad" of the chemistry sections which met for special drill. The class was said to be large and appreciative. —Following the resignation of President R. T. Milner, the board of directors elected Charles Puryear, who is dean of the college and head professor of mathematics, to serve also as president *pro tem.* until the new president can be chosen. —While the enrollment is not quite as large as last year, the character of work and the general tone of the whole campus have been very much improved.—The board of directors decided upon furnishing a free educational motion picture entertainment for the students each week. As the students all reside in dormitories on the campus this is a very desirable arrangement. It furnishes the students a place of entertainment for Saturday evenings and at the same time gives an opportunity of presenting certain instruction in an attractive way. The plan contemplates the use of the motion picture apparatus both for these general student entertainments and by the department of mechanical engineering for instruction purposes.—The new mess hall is being used this session for the first time and is proving very satisfactory. This building was erected at a cost of $120,000 and is admirably equipped in every respect. The dining hall seats 1,500 students and has provision for expansion to almost double that capacity.—The new main building is very near ready for use and will furnish ample room for several departments. This building will cost $225,000 and adds very much to the beauty of the campus.— By popular subscription funds have been raised to erect a Y. M. C. A. building in a conspicuous place on the campus. This building is being rapidly pushed to a state where it may

be used by the students. It will provide reading and recreation rooms as well as swimming pool, etc. It is believed that this will add much to the social life of the students and will bring the students and the campus residents into closer social relations.—With the resignation of Dean J. C. Nagle, his associate in the department of civil engineering Prof. D. W. Spence has been made head of the civil engineering department and dean of the engineering school. Professor Spence has been employed on the teaching force of the college for a number of years and is thoroughly acquainted with the workings of all its activities.

University of Washington.—The 17th annual short mining session attracted 44 students, including two women. Registration for the courses in quartz mining proved to be most popular, with placer mining second choice. No coal miners attended, but some students took up special work in fuel testing. Several college graduates enrolled as well as the usual number who have had less than a common school education. The oldest student was 62 years of age, the youngest 20.

Yale University.—The new electrical engineering laboratory connected with the Sheffield Scientific School was formerly opened on Thursday, November 6. Mr. Austin C. Dunham of Hartford, Conn., through whose generosity the new building was made possible, addressed the student gathering and referred in a striking manner to personal reminiscences in the electrical field during the past fifty years. Prof. W. L. Robb, of Rensselaer Polytechnic Institute, was also present and discussed the development of the Hartford Electric Light Company during the past twenty years. The meeting was in charge of Director Chittenden of the Sheffield Scientific School. Although not formally opened until November 6th, the building has been used for instruction purposes since the first day of the present college year. It is of interest to note that the contract was let and the building completed ready for occupancy in less than a year's time.

PEDAGOGICAL PSYCHOLOGY.

BY PAUL CLOKE,

Assistant Professor in Electrical Engineering, Rhode Island State College.

Rhode State College has this year inaugurated a freshman course called "How to Study." In connection with this work the class was given, in October, a psychological test for "individual differences." Graphs were made to show the distribution of class abilities in memory, perception, association, and arithmetical processes. Individual graphs were made also constructed to show the relative ability of each student in the four processes named above. At the time of the psychological test the professor in charge secured from the instructors the grades of the freshmen in all their subjects.

A comparison of the individual graphs and the grades revealed complete correspondence in forty-seven cases out of fifty-seven. Graphs that showed relative inefficiency in arithmetical ability were matched by the instructor's reports of low grades in mathematics. Graphic accusations of poor memory were substantiated by low grades in language work. Investigation of the ten cases where graphs and grades did not agree, resulted in the following explanations:

1. A student whose grades were uniformly high and whose graph was very low, said that he was sleepy and tired out at the time when he took the test.

2. Three students, with low grades and high graphs, gave continued ill health as the reason for the discrepancy.

3. The remaining six students admitted themselves guilty of laziness and slighting their college work.

The effect of the test seems to be a healthful stimulus to the students. One young man said that his low graph, closely corresponding to his record in class, had been a humiliating blow to what he now confessed to be his previous egotism.

Professor Boardman regards the "How to Study" course as merely in the experimental stage, but hopes it may prove helpful to freshmen and useful to the college authorities.

SUPERVISION OF ENGINEERING STUDENTS DURING THE SUMMER VACATION.

BY F. L. BISHOP,

Dean of the Engineering School, University of Pittsburgh.

This note on summer work is not written with the intention of criticizing in any way the practice of providing summer work for engineering students, but to call attention to certain conditions which engineering instructors who are not in actual contact with industries may easily overlook.

The value of work in engineering industries for students of engineering is much better appreciated today than ever before, although it has always been considered a desirable and valuable addition to the theoretical work of the class-room. Since the adoption of the coöperative system by some institutions, others have attempted to secure a part of the benefits of such a system by requiring work in engineering industries during the summer vacation. Students in these institutions which require summer work must secure positions for themselves at a time when the supply for such labor is far in excess of the demand. It follows that the average student without influence takes any position that he can secure, and this may or may not be in his chosen line of work. It may or may not be with a desirable firm or under a suitable oversight. The student works in the position without the expectation of any large financial gain because such positions do not pay large salaries. He does not expect much in such a temporary position but soon finds the position even worse than he expected. This condition soon causes him to lose interest in his work and possibly in engineering in general. Many times the work is beyond the ability of the young man and he fails to give satisfaction. The final effect of this is to call the attention of the firm to him in a most undesirable manner. The college is then blamed for the lack of training of the student.

Another class of students is found in those who do not like to work and who believe that they should not do so until after graduation. The required summer work for these students is a task to be finished with the least possible expenditure of energy. Their employers immediately assume that they are typical of the kind of student that comes from that particular school, with the result that the firms conclude that they do not need any of these men either before or after graduation.

Illustrations of both of these types have come under my observation during the past summer. The solution would seem to me to be found in the following: First, an investigation by the faculty of each position to be taken by a student and the permitting of only such work as meets with the approval of the faculty. Second,—adequate supervision of the work by a member of the faculty together with regular reports to the institution by the student.

SUMMER COURSE FOR COLLEGE TEACHERS.

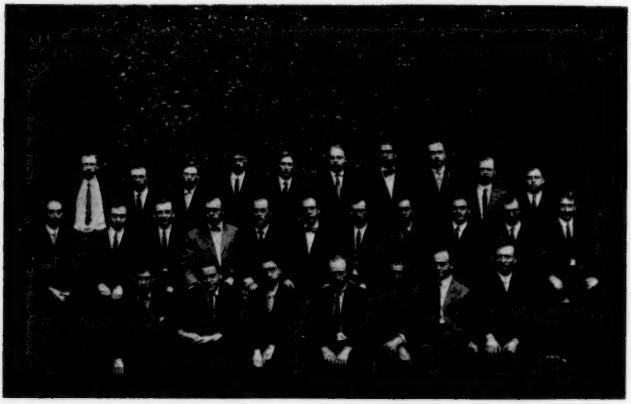
BY G. B. THOMAS,

Professor of Electrical Engineering, Colorado College.

The experiment during the summers of 1911 and 1912 in which college teachers of electrical engineering worked in the Westinghouse Electric & Mfg. Co.'s plant at East Pittsburgh proved so satisfactory that it was repeated in 1913. The experience gained in the two preceding summers aided materially in the arrangement of the program and consequently the course was stronger than before. Of the many applicants only about thirty could be accommodated. Preference was given to those having at least two years teaching experience and applying first. Their teaching experience averaged a little over five years and many of the men in the course had spent some time in practical work. Several of the Westinghouse men were present at each meeting, consequently the discussion of teaching problems had much value as the ideas

advanced were those which had been found to give results.

The accompanying program shows the work covered. There were two inspection trips in the shops each week and each was followed by a talk about the apparatus inspected, given by one of the engineers who had designed that special line. One evening a week was given over to the discussion of teaching problems. These discussions were opened by one of the college teachers and joined in by the company men and the other teachers. One evening a week was given to the consideration of the qualifications for success in the various lines of engineering work and how the college can develop these qualifi-



MEMBERS OF INSTRUCTORS' CLASS, 1913.

Top row, left to right: B. C. Dennison (Carnegie), J. F. Stevens (N. Dakota), J. B. Sheadel (Purdue), W. Buhl (Pittsburgh H. S.), C. C. Van Nuys (S. Dakota), L. R. Leonard (Colorado), V. C. Pritchett (N. Carolina A. & M.), D. D. Ewing (Purdue), W. L. Lodge (Mich. Agri.), J. A. Correll (Texas).

Middle row: E. B. Paine (Illinois), W. O. Goodwin (Bliss), S. P. Coale (Bliss), F. C. Bolton (Texas A. & M.), O. L. Britt (Okla. A. & M.), Geo. B. Thomas (Colorado Coll.), O. B. Wooten (Texas A. & M.), J. R. Eldred (R. I. State), W. T. Haines (Mont. State), J. B. Coleman (S. Carolina), A. R. Perrine (Miss. A. & M.).

Front row: W. B. Stelzner (Arkansas), J. J. Gilbert (Armour), J. R. Duncan (Kentucky State), F. J. Rankin (Colo. Agri.), H. H. Hoy (S. Dakota State), E. W. Kellogg (Missouri), F. A. Robbins (Iowa State Coll.).

cations. Excursions were held on Saturdays to other industries in the Pittsburgh district.

The men in the course gave the following as ways in which it had been helpful. (1) It gave a knowledge of the present types of electrical apparatus and the method of manufacture. (2) It gave an insight into the opportunities for college graduates with a large manufacturing company and equipped them to advise their graduates more intelligently whether or not they are qualified for successful work with such a com-

SCHEDULE OF SUMMER COURSE FOR COLLEGE TEACHERS - 1913

WEEK BEGINNING	MONDAY 3:30-7:00 PM EDUCATIONAL DEPT. LEADERS & INSPECTION OFF.	TUESDAY 10:30-12:00 M EDUCATIONAL DEPT. DISCUSSION OF PREVIOUS DAYS INSPECTION LED BY	TUESDAY 8:00-9:30 PM WESTINGHOUSE CLUB SUBJECT	TUESDAY 8:00-9:30 PM WESTINGHOUSE CLUB LED BY	THURSDAY 3:30-7:00 PM EDUCATIONAL DEPT. LEADERS & INSPECTION OFF.	FRIDAY 10:30-12:00 M EDUCATIONAL DEPT. DISCUSSION OF THE DAYS INSPECTION LED BY	FRIDAY 8:00-9:30 PM WESTINGHOUSE CLUB SUBJECT	FRIDAY 8:00-9:30 PM WESTINGHOUSE CLUB LED BY	SATURDAY EXCURSION TO
JULY 7	SUPPER 5:45 PM OFFICERS DINING ROOM	TALK BY ENGINEERING OPPORTUNITIES MR. RENSHAW	CO-OPERATIVE COURSES	MR. BISHOP MR. TAYLOR	D.C. GENERATORS MR. HALL MR. CHAMPION MR. SANDERS MR. PATTON	MR. HALL	SHOP ORDERS & METHODS OF HANDLING	MR. RUEL	WEST INGHOUSE BRAKE, UNION SW & SIGNAL CO
JULY 14	D.C. MOTORS MR. LANIER MR. MARTIN	MR. LANIER	RESEARCH IN COLLEGES	MR. DUNCAN MR. PAINE MR. SHANNON	A.C. GENERATORS MR. STEVENSON MR. BAIRD MR. MCCARTY MR. FIELD	MR. MCCARTY MR. FIELD	OPPORTUNITIES & QUALIFICATIONS	MR. JOHNSON	BUREAU OF MINES
JULY 21	TRANSFORMERS MR. MCCONAHEY MR. DE HAVEN MR. FAWCETT	MR. MCCONAHEY	PLACE OF ELECTRICITY IN MACHINE DESIGN BY ECONOMICS IN TRAINING OF ENGINEER	MR. HERCHEY MR. JAMES MR. WILLETT	METERS	MR. MACBRAIR MR. BRADSHAW	SALES OPPORTUNITIES AND QUALIFICATIONS	MR. MASTERS	JONES & LAUGHLIN
JULY 28	INDUCTION MOTORS MR. DUDLEY MR. SORGER MR. SOMERFELD	MR. DUDLEY	LABORATORY EQUIPMENT REPORTS	MR. PERKINS MR. CORNELL MR. OLIN MR. BENNETT	ROTARIES MR. VARDLEY MR. MATTHEWS MR. EMENS	MR. VARDLEY	ENGINEERING REQUIREMENTS AND QUALIFICATIONS	MR. LAMME	ASPHALT FILTRATION BEDS
AUG 4	SWITCH BOARDS CIRCUIT BREAKERS MR. RANDALL MR. SIEMON MR. BITTELER	MR. RANDALL	APPLIED ENGINEER ING COURSES	MR. EWING MR. STEVENS MR. MAPLES MR. BOLSE	INDUSTRIAL CONTROL MR. WALLACE MR. SEMAN MR. BITTNER	MR. WALLACE	RESEARCH	MR. SHANNER	PRESSED STEEL CAR CO
AUG 11	RAILWAY MOTORS & LOCOMOTIVES MR. MOODY MR. WIRTH MR. STORER	MR. STORER	TEACHING OF ELECTRICAL THEORY	MR. WHITNEY MR. WARA MR. KELLOGG	MACHINE CO. 5:45-7:45 PM	MACHINE CO. 10:30-12:30 LUNCH	SUPPER 5:45 PM OFFICERS DINING ROOM		

pany. (3) It brought them into personal contact with successful men in the organization. (4) It broadened their acquaintance in their own profession. (5) It gave them new ideas on teaching methods.

As a final evidence of the success of the course it need only be stated that a similar course is being planned for the summer of 1914.

GOOD READING FOR ENGINEERS.

Professor J. M. Telleen, head of the department of English in the Case School of Applied Science, has just issued a list of reference books from which the reading of the students may be chosen. Each engineering student is required to cover a great deal of ground in his readings and to pass examinations thereon. The titles given are those of books which may be substituted for readings in the required list. The amount of credit for each is determined in a conference between student and instructor. The list makes no claim as to exhaustiveness but is rather suggestive.

English Language and Composition.

BATES, A.—Talks on Writing English. GREENOUGH, J. B. and KITTREDGE, G. L.—Words and Their Ways in English Speech. KRAPP, G. P.—Modern English—Its Growth and Present Use. LOUNSBURY, T.—Standard of Usage in English. PALMER, G. H.—Self-cultivation in English.

Poetry.

The student may read the works of any poet of note or portions of anthologies compiled by LOUNSBURY, MANLEY, PAGE, PALGRAVE or STEADMAN.

Fiction.

In the reading of fiction the student may make his selection from the lists found in the appendixes of BLISS PERRY'S A Study of Prose Fiction and W. L. CROSS'S Development of the English Novel, or from the list prepared by W. L. PHELPS, entitled: List of General Reading in English Literature.

Drama.

The student may make his selection from Elizabethan plays of merit or from the plays of modern dramatists as BRIEUX, GALSWORTHY, LADY GREGORY, IBSEN, MAETERLINCK, ROSTAND, SYNGE, YEATS. GAYLY, C. M.—Representative English Comedies. PRICE, W. J.—Technique of the Drama.

Essays.

BENSON, A. C.—From a College Window. CLIFFORD, W. K.—Lectures and Essays. EMERSON, R. W.—Essays. HIBBEN, J. G.—A Defence of

Prejudice and Other Essays. STEEVES, H. R. and RISTINE, F. H.—Representative Essays in Modern Thought. STEVENSON, R. L.—Essays. (Consult also W. L. Phelps' List of General Reading.)

Journalism.

DEVINNE, T. L.—Correct Composition. HARRINGTON, H. F. and FRANKENBERG, T. T.—Essentials in Journalism. HOLT, H.—Commercialism and Journalism. ROSS, C. G.—The Writing of News.

Art.

CAFFIN, C. H.—Photography as a Fine Art. COX, KENYON—Painters and Sculptors. EASTMAN, MAX—The Enjoyment of Poetry. KREHBIEL, H. E.—How to Listen to Music. MORRIS, W.—Art and Its Producers. ROBINSON, C. M.—Modern Civic Art. SCHAUFFLER, R. H.—The Musical Amateur. STATHAM, H. H.—Architecture for General Readers. STURGIS, R.—Appreciation of Sculpture; How to Judge Architecture. VAN DYKE, J. C.—What is Art? WITT, R. C.—How to Look at Pictures.

History.

COOLIDGE, A. C.—The United States as a World Power. CUNNINGHAM, W. and MCARTHUR, E. A.—Outlines of English Industrial History. DRAPER, J. W.—Intellectual Development of Europe. FISKE, J.—The Critical Period of American History. FROUDE, J. A.—English Seamen of the XVI Century. KING, R.—History of Ohio. LATANI, J. H.—America as a World Power. LECKY, W. E. H.—French Revolution. PARKMAN, F.—LaSalle. PRESCOTT, W. H.—Conquest of Mexico. SEIGNOBOS, C.—History of Medieval and Modern Civilization. SMITH, G.—Three English Statesmen. TAINE, H. A.—French Revolution. WARNER, G. T.—Landmarks in English Industrial History. WILSON, W.—History of the American People.

Political Science.

BRYCE, J.—American Commonwealth; Hindrances to Good Citizenship. HART, A. B.—National Ideals Historically Traced; Practical Essays in American Government. HOWE, F. C.—The City. SMITH, J. A.—Spirit of American Government. WILCOX, D. F.—Great Cities in America; American Cities.

Psychology and Philosophy.

DELAND, L. F.—Imagination in Business. EUCKEN, R. C.—Main Currents in Modern Thoughts. HADLEY, A. T.—Standards of Public Morality. HIBBEN, J. G.—The Philosophy of the Enlightenment. JAMES, W.—Talks to Teachers; Psychology. KING, H. C.—Laws of Friendship; Rational Living. MCCABE, J.—Evolution of Mind. PAULSEN, F.—System of Ethics. SCOTT, W. D.—Psychology of Advertising. SPENCER, H.—Data of Ethics.

GOOD READING FOR ENGINEERS.

Sociology.

ADDAMS, JANE—Spirit of Youth and the City Streets. BARTLET, D. W.—The Better City. DAVIS, M. M.—Exploitation of Pleasure. DEVINE, E. T.—Social Forces. FITCH, J.—Steel Workers in Pittsburgh. HARTT, R. L.—People at Play. HUSBAND, J.—A Year in a Coal Mine. LEE, J.—Constructive and Preventive Philanthropy. OWEN, R.—Essays on the Formation of the Human Character. RAUSCHENBUSCH, W.—Christianity and the Social Crisis; Christianizing the Social Order. REDFIELD, W. C.—The New Industrial Day. THOMSON, J. A.—Heredity. TOLMAN, W.—Social Engineering.

Hygiene.

CARRINGTON, T. S.—Fresh Air and How to Use It. ELLIS, H.—The Task of Social Hygiene. GULICH, L. H.—The Efficient Life; Mind and Work. HUTCHINSON, W.—Preventable Diseases. OLIVER, T.—Diseases of Occupation. WILEY, H. W.—Foods and Their Adulteration.

Engineering and Science.

DARWIN, C.—Origin of Species. FISKE, J.—A Century of Science. HUXLEY, T. H.—Science and Education. JORDAN, D. S.—The Call of the Twentieth Century. LUCKE, C. E.—Power. MCCULLOUGH, E.—Engineering as a Vocation. MORISON, G. S.—The New Epoch. PORTER, C. T.—Engineering Reminiscences. SALEEBY, C. W.—The Cycle of Life; Evolution, the Master Key to Science. SHALER, N. S.—Man and the Earth. SNYDER, C.—New Conceptions in Science. TALBOT, F. A.—Railway Conquest of the World; Steamship Conquest of the World. TYNDALL, J.—Fragments of Science. WADDELL, J. A. L. and HARRINGTON, J. L.—Addresses to Engineering Students. WILLIAMS, H. S.—The Story of the Nineteenth Century Science.

Efficiency Engineering.

EMERSON, H.—Efficiency. GOING, C. B.—Principles of Industrial Engineering. SCOTT, W. D.—Increasing Human Efficiency in Business. TAYLOR, F. W.—Principles of Scientific Management.

Travels and Nature.

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THE TECHNICAL HIGH SCHOOL AND THE ENGINEERING COLLEGE.

BY HARRISON E. WEBB,

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So closely interrelated are the various aspects of American educational activity that it is extremely difficult to discuss any particular educational topic without analyzing the whole field; particularly if one aspires to the advocacy of a radical change in educational method or of a recasting of the relative values of educational elements.

Changes in Educational Methods.

It is not easy to comprehend the full extent of such revaluation which the last quarter century has witnessed. Subjects once regarded as essential to liberal training are now openly disregarded, while others almost unheard of twenty-five years ago now occupy the foremost place in professional education. Time units, too, have changed, brief intensive courses having given place to continuous study extending over several years, the subdivision of which is regarded as a matter of convenience rather than an essential of educational method. Correlation between departments of instruction has been carried to an extreme; sometimes, unfortunately, so far as to involve a repetition of identical work

But one factor has remained nearly constant. Now, as formerly, it is eminently desirable that a student should begin his active work in the world at about the age of twenty-two. In consequence the traditional division of his time into eight years of grammar school, four years of high school, and four years of college has remained fixed. And this in the face of an astounding increase in the field of human knowledge, if a somewhat longer period of years be allowed for consideration, and as well in spite of increasing demands for popular

education, and the consequent breaking down of rigid standards of scholarship.

Demands Upon the Educational Process.

The situation which presents itself to an educator of to-day, if he endeavors to compass the whole problem, borders closely upon the impossible. From one direction comes the call for greater refinement of process, training in which involves the highest degree of specialization; from another comes the demand for all-round men who are fairly well at home in any task within a broadly limited field; in a third quarter we hear that education must be for all the people and not merely for the few who are possessed of special aptitudes; and finally, we are frequently informed that the whole business of education is nowadays altogether too expensive. If teachers of high and low degree were to take to themselves all of these demands, the only result would be hopeless confusion. Sometimes it is hard to escape it as it is. A business man of some prominence recently entertained the writer with a criticism of education in general and of technical education in particular. His remarks were mostly in the negative. But as a mental exercise it seemed worth while to reconstruct the man who would suit him, with this result; we should turn out a man who would as a civil engineer select the best of a number of power sites; as a mechanical engineer design and supervise the erection of a dam and a small power plant; as an electrical engineer install units and provide for adequate distribution of power; as a chemical engineer find some use for the power; as an efficiency engineer attend to all employment; as a doctor of medicine look after the health of the employees in camp; and finally as an expert accountant open a complete set of books. The salary which this paragon was to receive would not have entailed any considerable cut in expected dividends.

Curriculum Efficiency.

It is easy to laugh at this sort of extravagance. But there is no escape from the fact that the all-round man, the man of

vision and imagination, is the one who is universally wanted. As teachers we can impart very little, if any, of the imaginative quality to students. It seems to be a trait inborn, which makes itself known from babyhood. But at least we should beware of stifling this quality by excessive emphasis upon routine. For the rest, we should go to the extreme in avoiding non-essentials in instruction.

This spells "efficiency" in the broad usage of the present day. The word has been badly abused in its relation to education. One thing, however, it must mean, and that is, *economy of the student's time and effort,* if he is to have a speaking acquaintance with the immense field of engineering practice.

Investigation into the "leakages" in students' time may be conducted along several lines.

1. There is a question of method of instruction, as Professor Smallwood has recently pointed out in a very pungent essay in the BULLETIN.

2. There is the administrative question of "correlation without duplication" between departments of instruction.

3. There is the necessity of dealing with that form of organized foolishness which usually masquerades as "college spirit."

4. There is the matter of non-essentials in instruction which are deeply interesting to the instructor, but to no one else in particular.

5. There is the very serious moral question regarding the student who is palpably beyond his depth. Have we a right to attach to such a student the stigma of failure, because he has reached the full measure of his capacities? Every school and college is proud of its best, and justly so. It is easy, however, to hug too closely certain mediæval notions of the sanctity of graduation. The proper balance of emphasis between theoretical exactitude and practical applicability of principles differs widely in the case of different students. As a result individual students often waste much of their time, on the one hand, in untangling logical complications in which they have no interest, or, on the other, in mastering mechanical

processes for which they are naturally unfitted. As a further result many such students are accounted failures, while men of mediocre ability more evenly distributed succeed, only to find themselves inferior in practical life to those whom they surpassed in college.

This state of affairs is often urged as a sort of blanket indictment against college methods. As such, of course, it will not hold. But schools and colleges might well openly accept a principle that a student be allowed to discontinue his studies at certain stated times without discredit to himself, and so take honest pride in having afforded him such schooling as he has, and in his later achievements.

6. The items of "leakage" above referred to apply equally well to secondary school and college. But there is, in the opinion of the writer, a still greater loss of students' time and energy in the transition between school and college. It is at this stage of a student's career that, as a rule, he encounters a well-defined break which is often so violent as to upset his intellectual equilibrium.

The Function of The High School.

Until comparatively recent times, the high school has been in its ideals primarily a preparatory school. The fact that for years colleges have claimed less than 10 per cent. of entrance enrollment of the high schools of the country had little influence upon the curriculum. But about fifteen years ago technical and manual training high schools commenced to spring up in the various cities of the United States, and these have served to modify somewhat the general character of secondary education.

Their establishment seems to have arisen partly in response to popular demand for institutions where students might be sent who had failed in literary courses, and partly in the way of application of a popular psychological theory of educational method. Far-sighted men were dubious of their success. But though it was soon found that manual training afforded just as great an opportunity for failure as literary

study, and though the "doctrine of interest," with its attendant miseries, some time ago went into "the discard," these schools have come to fill an important place in educational practise, and, it may safely be said, have come to stay. For it appears that their very existence, and the necessities of a characteristic curriculum, have served to accentuate the importance, even for students of high-school age, of anchoring principles and rules of thought to experience with the external world. They have shown that the best mental discipline in school is of the same order as that which the student must some time encounter in the everlasting school of experience.

So far are these schools from filling the rôle of accelerator of retarded pupils that they are actually attracting the more brilliant of the high-school population, boys and girls who are eager for the problems presented by actual conditions. In this way the position of the technical high schools among high schools of the country is analogous to that of engineering schools among institutions of higher learning.

Obviously the one thing needed to establish beyond question the value of the technical high schools as educational instrumentalities is the hearty interest of the engineering colleges, and a genuinely coöperative effort on the part of both to solve the great problem of practical education. Their ideals are the same, ideals of perfection in work itself rather than in the mere appreciation of work done by others.

Entrance Requirement Fallacies.

Now the entrance requirements of most engineering schools at present (at least as far as the writer is aware) are met as well by old-standard college preparatory methods as by the technical high schools. Nay more, there sometimes seems to exist a sort of suspicion on the part of the former that the latter are endeavoring to ape the methods of their betters without either the ability to do thorough work or the student material to work on. As a result there has arisen a tendency to "stiffen" entrance requirements by increased intricacy

in problems set for examination and by increased emphasis upon mathematical theory.

This, the writer contends, is distinctly a move in the wrong direction. There is probably no more useless way for a student to spend his time than in preparing for a set of examinations known in advance to be difficult far beyond the usual run of his school work. The examination acquires a wholly fictitious value for him, and his ideal of work, of real accomplishment, is twisted into one of cleverness in outwitting his superiors. And as for mathematical theory, it is high time for a widespread recognition of the fact that absolute logic is as far beyond the reach of an immature high school student as is the construction of a railroad.

True Preparation for College.

The true basis of coöperation between engineering colleges and technical high schools is the pupil himself. His progress from the lower to the higher institution should be accomplished by a mutual recognition of the essential value of both grades of work. And his "preparation" for college should be of such a character that if for economic or other reasons he finds it necessary to discontinue his schooling before "graduating" from high school, he shall have a training definitely valuable for a career in some humbler sphere of activity.

There are a hundred situations of inferior grade, wherein a modicum of engineering knowledge is of value, to one which really demands the services of a graduate engineer. Is it not better, let us ask, that such positions should be filled by men whose memories of school are those of well-defined successes along practical lines than by men who are forced to look back upon their school days as a downward progress to final failure, or by " rule-of-thumb " men whose boast is of their ignorance of the very elements of what they are trying to do?

The definitions of what constitutes college preparation have suffered greatly from a mania for classification. "Elementary algebra" is adhered to as a suitable requirement, in disregard of the fact that many problems in elementary algebra are more

difficult of solution than easy problems in the calculus. Consider the traditional course in solid geometry, for another instance, with theorem after theorem solemnly stalking by to "prove" something so apparent that its denial would be utterly ridiculous, with page after page of argument about limits which in the light of modern theory is so viciously incorrect as to be laughable, yet not a word about the prismoidal formula. Yet many a student has "failed" to enter college because of his inability to assimilate this junk. On the other hand it does not follow because a high-school course in descriptive geometry, or in strength of materials, or in the elements of surveying, is spread out rather thin for the sake of the immaturity of the student, that it is useless, or even improper as a preparation for advanced work of the same character.

It is safe to say, for example, that a student who has had four consecutive years in the drafting-room of a high school is better prepared for elementary work in machine design than one whose acquaintance with the relations of lines and points is derived from high-school geometry. It is safe to urge that a student whose high-school course has involved a half year of shop mechanics is better prepared for a course in kinematics than one who has devoted the same length of time to unraveling intricate tangles of exponents and radical forms. It might be said with reason that a thorough acquaintance with the principles of arithmetic applied in the field of technology is a more valuable asset than the ability to manipulate the ultimate complexity of complex fractions in algebra.

The engineering colleges can perform an immense service for the technical high schools first, in recognizing the essential validity of their practical teaching, and then, by wise counsel, in aiding in the outlining of such courses to the elimination of inefficiency. Are they ready to undertake this work?

It is a bold thing to say, but the writer has sometimes pondered the question as to whether the engineering colleges might not learn from the technical high schools, young as they are, the lesson of so adjusting their curricula as to send

a man out at one of a number of points in his course, so equipped that, while far from being the equal of the graduate engineer, he is ready to fill some less exacting role with credit to himself and honor to his institution.

Finally, let us hope that it will be found worth while, at some early date, so to standardize the comparative difficulty of set problems in various subjects desirable for progress in high school and college work that the student may easily take his own measure and so find time for consideration of those broadening elements which are supremely valuable to his high school years.

RESEARCH WORK IN THE TECHNICAL UNIVERSITIES OF GERMANY.*

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Research Work—Its Status and the Conditions Governing It.

The research work which is carried on in the engineering laboratories or in industrial establishments under the supervision of the faculties of the various universities may be classified somewhat as follows:

I. That done by undergraduates,
II. That done by graduate students,
III. That done by professors and others of the older members of the instructing staff.

I. With regard to the work done by undergraduate students it may be said in general that in comparison with our own

* The following article presents in condensed form the principal portions of a report recently prepared by the writer for President Maclaurin, of the Massachusetts Institute of Technology.

institutions there is relatively less research work of an experimental nature done by undergraduate students as such.

II. With regard to the second class we may distinguish the following groups:

II*a*. Graduate students who elect to pursue work at the technical universities leading to the acquirement of the honor degree of Doctor of Engineering (Doktor-Ingenieur), and who devote their time exclusively to this work.

II*b*. Such graduate students as have time available for research, though connected with industry, and who also have the means and the desire to do investigational work, usually for the doctor title.

II*c*. Those graduate students who become enrolled in the instructing staff of the technical universities as assistants in various capacities to the instructors or professors.

III. Concerning the research work which is done by professors and older members of the instructing staff of a given technical university the following may be said:

The professors and instructors, usually without exception, stand in close relationship to one or more industries whose particular field is most closely related to their own. They thus come in contact very frequently with unsolved problems which arise in the progress of industry and are enabled in many cases to gain the assent of industrial concerns to an investigation of these. A second class of problems suggested not by the experience of a single industrial concern but by such phenomena as the introduction and the use of high speed steel in the metal industries, for example, or the establishment of a uniform code of rules regarding steam boilers or steam piping, or an international system of screw threads, generally brings up questions which it is desirable to have answered by authorities who are capable of impartial and decisive statements of truths derived from investigations. Foremost among the agencies which stimulate this class of investigations is the well-known society of German engineers, Der Verein deutscher Ingenieure, whose province is principally mechanical engineering, but whose interests also include the broader problems of

civil and electrical engineering. Through committees of this association the field of applied science and industry has been very carefully looked over and the large sums of capital which this society controls have been rendered available in part for the use of committees dealing with these questions, for apportionment by them and for the making of grants to eminent men for the purpose of defraying the costs of the investigations which they involve.

Methods of Rendering Available Results of Investigations.

The means used for the dissemination of the information gained in the course of the investigational work in which the above classes of men are interested is particularly well-arranged and far-reaching in its nature and is worthy of consideration in connection with the general subject.

As the Verein deutscher Ingenieure in its far-sightedness has provided for the statement of problems, for their classification, and for their assignment to those capable of dealing with them, it has also provided in several ways for the accumulation and dissemination of the information thus gained and in the following way:

The journal of the society, known as the *Zeitschrift des Vereines deutscher Ingenieure,* is utilized as an organ for the publication of such material gained in the course of investigations carried on by any of the above classes of men as may be of general interest to the engineering fraternity. Usually, in addition to this, reprints of the researches are issued and these are intended to contain more detail and fuller accounts of the work than it may be desirable, for various reasons, to include in the statements published in the journal. These reprints form the second means established under the above auspices for the dissemination of the results of investigations and are given out as the "Mitteilungen über Forschungsarbeiten auf dem Gebiete des Ingenieurwesens insbesondere aus den Laboratorien der technischen Hochschulen." They form, then, a series of

pamphlets published from time to time, as the material collects, and they are designed to present in the best form possible all of the data accumulated in the solution of any problem which has been the subject of investigation. The origin of this form of publication may be attributed to an arrangement reached by the directors of all the engineering laboratories of the technical universities and the editorial staff of the *Zeitschrift des Vereines deutscher Ingenieure* during a study which was made when the laboratories were first begun. This study comprised all possible means for disseminating information upon enineering questions and the above plan is the result. Both the journal and the "Mitteilungen" are intended as a field of publication open not only to the investigators above outlined but also to all others engaged in industry or in scientific work who have material worthy of publication on questions relating to this class of scientific activity. In connection with the publication of this series of pamphlets it may be noted that the cost of their publication is borne to a great extent by the management of the *Zeitschrift des Vereines deutscher Ingenieure,* which makes it possible to issue them at a price low enough to put them in reach of all students of engineering as well as of the younger men in engineering practice.

The above are two single examples illustrating the means adopted for spreading and making accessible the results of investigational work. In addition to these, a number of other means for dissemination of information gained through research exist or have existed.

The Facilities and Means Available for Research and Investigational Work.

In connection with a study of the status of research work one of the most important questions to be considered is that dealing with its financing. Evidently, since these technical universities are state institutions, their sources of income comprise both the state treasuries and the resources of those private individuals or interests directly concerned with any investigations that may be carried on or who are altruistically

inclined toward the activities with which the institutions are identified.

Grants for purposes of special investigations of industrial conditions are possible, as in the case of Prof. Schlesinger, of Charlottenburg, whose expenses for a trip made for the purpose of investigating the methods in vogue in industry for determining costs of production, were paid from the educational funds appropriated by the state.

Finally, mention may be made of money available from "foundations," *i. e.*, funds set aside through gifts or otherwise for advancing work of science. Such is the "City of Charlottenburg Foundation," the income of which is applied to investigations and research under the auspices of the director of the Machine Laboratory of the Charlottenburg school.

THE MODERN LANGUAGE COURSES AT CASE SCHOOL.

BY A. S. WRIGHT,

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The modern language courses at Case School of Applied Science are the result of an effort to adapt the instruction to the spirit of an engineering school. We attempt to correlate them with the engineering courses, and to make them an organic part of the curriculum. This correlation is secured partly through the coöperation of the several department faculties. All work is planned, all reading matter selected, with a view to meeting the needs of the different groups of students. We find that the interest of each group is directly proportional to the interest of the teachers of the group in the subject. When students realize that their instructors actually use foreign periodicals and will require students to use them, they are apt to approach their language work in a scholarly spirit. The first aim of our work we frankly state to be, to develop the ability to make easy use of

technical literature. Our courses have thus, as have all of the technical courses, a definite aim and we deem it a worthy one. The foreign technical literature is so abundant and so valuable that the student who can use it has an asset which he increasingly appreciates.

Why the Study of German Is Emphasized.

Our courses are mainly German, although Spanish is taught as a senior elective, and a course in French is offered for certain students. We emphasize German for the following reasons: First, because its technical literature has great intrinsic value. In no other foreign tongue are there so many treatises, monographs and periodicals of value to the engineer, for both in research and in practical applications the Germans stand at the forefront in nearly every line of engineering. Second, the language is so difficult that the students need all of the twelve semester-hours allowed to acquire it. Third, in the middle West, all good high-schools teach German, so that we are able to require two units of preparation for admission. This makes it possible to start our students at once in the study of scientific German.

Continuity Desirable.

Freshmen take German three hours a week, sophomores, two hours and juniors, one hour. We thus secure a continuous course of five years' duration. In addition to this, some departments give in the senior year, a seminar for the discussion of periodical literature. The advantage of this continuity is evident. Our graduates have been drilled in the language throughout their course. More than this, they have subscribed for and used a foreign periodical. All possible has been done to impress upon them the importance of the foreign literature. We expect to see an increasing number of them subscribing for and using some foreign technical journal in their particular lines of work.

Freshman German.

First year students begin with a science reader. Of these there are several fairly well adapted for the acquisition of the vocabulary of elementary science. This year the class is reading "Grundzüge der Naturlehre," published by D. C. Heath and Co. The book covers the subjects of heat, magnetism, electricity and elementary chemistry. During this early work, attention is centered on vocabulary and sentence construction, especially the so-called "participial construction." This latter is characteristic of scientific German, and must be thoroughly mastered.

This book having been completed, the remaining work of the first year consists in the translating of articles taken from scientific journals or books. These are placed in the hands of the students in mimeographed form. One of our difficulties is to provide suitable reading material. There is great need of a series of science texts, graduated as to difficulty.

The final examination is the sight translation of articles descriptive of scientific processes, apparatus, etc. Students are thus put upon their mettle. They realize that there are no short cuts, that there is no help possible through translations or from their neighbors. The method contributes to self-reliance and honest work.

Sophomore German.

At the beginning of the second year, each student subscribes for a German journal of general science which furnishes the major part of the reading for the year. Last year we read "Technische Monatshefte." This year we are reading "Der Ingenieur." While waiting for our journal, we read some technical monograph, generally "Die Elektronentheorie," published by Heath & Co.

Our paper gives a survey of the whole field of engineering, covering such subjects as Maschinenbau, Bauingenieurwesen, Verkers- und Transportwesen, Heizung, Beleuchtung, Wasserversorgung, Metallographie, Chemische und Mechanische

Technologie. We are thus enabled to differentiate the work and to begin to prepare our special vocabularies. Students come to realize that they are working toward a definite goal and their interest is increased accordingly.

During the second semester, a course of lectures (with parallel reading by the class) covers the following subjects: An outline of the history of Germany; the political constitution of the Empire; municipal government; educational and social institutions; commercial methods, with special reference to technical training. By the aid of a large collection of lantern slides the students are familiarized with the architecture of the leading German cities and the chief points of historical interest, as well as with commercial plants and processes.

Junior German.

The junior German is unfortunately limited, at present, to one hour per week. Two hours would be much better. The class is divided into departmental groups, which are kept small, rarely containing over twelve students. We sit around a table, upon which are placed technical journals and dictionaries, trade catalogues, etc. The class meets rather in conference than for formal recitations. Written abstracts, prepared in advance, take the place of translations. The assignments are articles suggested, sometimes by the heads of the departments, sometimes by the students themselves—all, of course, being subject to the approval of the language instructor.

In place of the general science journal, departmental journals are used, or some treatise or monograph pertaining to the particular line of study of each group. The 'Miners' are at present using "Metal und Erz"; the 'Electricals' "A.E.G.-Zeitung"; the 'Mechanicals' "Der Ingenieur"; the Chemists "Fortschritte und Probleme der Chemischen Industrie," an address by Prof. Duisberg.

During the year, a special word-list is prepared for each group. These lists are kept in the form of a card catalogue,

in the making of which the students assist. Technical dictionaries, as we all know, are always incomplete. They may not contain such expressions as "Doppelmotor," or "Einankermotor." Students become interested in the discussion of words and meanings, and learn not only German, but some technology. The language instructor certainly learns also. Our final examination is always the translation at sight or the abstracting at sight of technical articles.

Conclusions.

In closing allow me to present a few general considerations. The course outlined above will hardly meet the approval of all educators, especially of modern language teachers. A foreign language is usually studied, and ought to be studied, for cultural results. There can be no question but that a long and thorough study of a foreign tongue does quicken the perception, develop analytic power, broaden the horizon, give intellectual poise—in a word, contribute to culture. But it would be fatuous indeed to claim that any brief course, such as is offered in an engineering school, leads to any such results. Nor does the average short literary course lead to any practical result. Students who are fairly familiar with the style and vocabulary of romance and drama are quite unable to analyze a scientific article. The study of Schiller's dramas is not a good preparation for reading the *Elektrotechnische Zeitschrift*, and that is what the electrical engineer wants to read. He desires a key to unlock a particular literature. After talking with many engineers on the subject I feel sure that engineers, at least, will approve of a course adapted to meet a practical end.

It is to be regretted that there has never been an authoritative statement either of the end of modern language study in engineering schools or of the methods by which the end may be attained. In point of fact the languages find it hard to maintain themselves in the curriculum. The work of every engineering school becomes increasingly intensive; new sub-

jects, all-important in the esteem of the heads of departments, are forced into the curriculum each year. Unconsciously we give technical subjects the precedence. Liberal studies are crowded into a corner so small that they have no breathing room. If under these conditions language-study is to be retained as a part of the curriculum, it must adapt itself to the needs of the students.

The ideal teacher in such a course would be a man trained in science, who is also a linguist. As such an one is hardly to be found, the best we can do is to secure a linguist who is interested in science. It may seem dull work for a linguist, but, like all teaching, it becomes interesting when once a sympathetic attitude is secured on the part of the students.

Finally, for the success of such a course, the coöperation of the departments is essential. In two of our departments, a senior seminar is conducted for the discussion of foreign periodicals. This makes the work continuous through the four years. We hope to induce other departments to establish similar courses.